CHAPTER 24

LIST OF EFFECTIVE TEMPORARY REVISIONS

FOLLOWING IS A COMPLETE LISTING OF ALL ACTIVE TEMPORARY REVISIONS (TR'S). TR'S NOT LISTED SHOULD BE REMOVED. THE ATA NUMBER, CONFIG CODE AND PAGE NUMBER IDENTIFIES THE PAGE PRECEDING THE TR.

TR NUMBER	ATA NUMBER	CONFIG CODE	PAGE NUMBER	TR DATE
NONE				

CHAPTER 24

ELECTRICAL POWER

LIST OF EFFECTIVE PAGES

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
List of Effective Pages	1	Dec 15/95	
	2	Dec 15/95	
	3	Dec 15/95	
	4	Dec 15/95	
	5	Dec 15/95	
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	7	Dec 15/95	
	8	Dec 15/95	
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	3	Nov 15/86	
	4	May 15/89	
	5	Nov 15/86	
	6	Nov 15/88	
	7	Nov 15/88	
	8	Nov 15/88	
24-conts	1	Dec 15/91	
24-conts	2	Jun 15/92	
24-conts	3	Jun 15/92	
R 24-conts	4	Dec 15/95	
24-conts	5	Aug 15/82	
24-conts	6	Aug 15/82	
24-DIAGM	1	Aug 15/82	
24-DIAGM	2	Jul 15/84	
24-DIAGM	3	Aug 15/82	
24-DIAGM	4	May 15/87	
24-DIAGM	5	Nov 15/83	
24-DIAGM	6	Aug 15/82	
24-DIAGM	7	Nov 15/82	
24-DIAGM	8	Nov 15/83	
24-DIAGM	9	May 15/85	
24-DIAGM	10	Aug 15/82	
24-DIAGM	11	Aug 15/82	
24-DIAGM	12	Nov 15/82	
24-INDEX	1	Dec 15/91	
24-INDEX	2	Mar 15/84	
24-INDEX	3	Aug 15/82	
24-INDEX	4	May 15/87	
24-INDEX	5	Dec 15/91	
24-INDEX	6	Dec 15/91	
24-INDEX	7	May 15/87	
24-INDEX	8	May 15/87	
24-INDEX	9	May 15/87	
24-INDEX	10	May 15/87	
24-INDEX	11	May 15/87	
24-INDEX	12	May 15/89	
24-INDEX	13	May 15/87	
24-INDEX	14	May 15/87	
24-INDEX	15	May 15/87	
24-INDEX	16	Jun 15/93	
24-INDEX	17	Jun 15/93	
24-INDEX	18	Jun 15/93	
24-INDEX	19	Jun 15/93	
24-INDEX	20	Jun 15/93	
24-00-00	1	Mar 15/80	
24-00-00	2	Nov 15/82	
24-00-00	3	Mar 15/91	
24-00-00	4	Aug 15/81	
24-00-00	5	Aug 15/81	
24-00-00	6	Aug 15/81	
24-00-00	7/8	Mar 15/84	
24-00-00	9	Dec 15/79	
24-00-00	10	Dec 15/79	
24-00-00	11	Nov 15/84	
24-00-00	12	Mar 15/91	
24-00-00	13/14	Aug 15/81	
24-00-00	15	Mar 15/84	
24-00-00	16	May 15/87	
24-00-00	17	Mar 15/84	
24-00-00	18	Mar 15/84	
24-00-00	19	Aug 15/81	
24-00-00	20	Aug 15/81	
24-00-00	21	Mar 15/84	
24-00-00	22	Mar 15/84	
24-00-00	23	Mar 15/84	
24-00-00	24	May 15/87	
24-00-00	25	May 15/87	
24-00-00	26	May 15/87	
24-00-00	27	May 15/87	
24-00-00	28	May 15/87	
24-00-00	29	May 15/87	
24-00-00	30	May 15/87	

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24-00-00	32	Aug 15/81	
24-00-00	33/34	May 15/87	
24-00-00	201	May 15/85	
24-00-00	202	May 15/85	
24-00-00	203	May 15/85	
24-00-00	204	Aug 15/81	
24-00-00	205	Aug 15/81	
24-00-00	206	Aug 15/81	
24-00-00	207	Aug 15/81	
24-00-00	208	Aug 15/81	
24-00-00	209	Aug 15/81	
24-00-00	210	Aug 15/81	
24-00-00	211	Aug 15/81	
24-00-00	212	Aug 15/81	
24-00-00	213	Aug 15/81	
24-00-00	214	Aug 15/81	
24-00-00	215	Aug 15/81	
24-00-00	216	Aug 15/81	
24-00-00	217	Aug 15/81	
24-00-00	218	Aug 15/81	
24-00-00	219	Aug 15/81	
24-00-00	220	Aug 15/81	
24-00-00	221	Aug 15/81	
24-00-00	222	Aug 15/81	
24-00-00	223	Aug 15/81	
24-00-00	224	Aug 15/81	
24-00-00	225	Aug 15/81	
24-00-00	226	Aug 15/81	
24-00-00	227	Aug 15/81	
24-00-00	228	Aug 15/81	
24-00-05	401	Apr 1/72	
24-00-05	402	May 15/87	
24-11-00	1	Mar 15/84	
24-11-00	2	Aug 15/81	
24-11-00	3	Mar 15/84	
24-11-00	4	Mar 15/83	
24-11-00	5/6	Dec 15/80	
24-11-00	7	Aug 1/72	
24-11-00	8	Sep 15/80	
24-11-00	9/10	May 15/87	
24-11-00	11	Dec 1/72	
24-11-00	12	Mar 15/84	
24-11-00	13	Jan 15/73	
24-11-00	14	Aug 15/81	
24-11-00	15	Aug 15/81	
24-11-00	16	Aug 15/81	
24-11-00	17	May 15/87	
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24-11-00	20	May 15/87	
24-11-00	21	Mar 15/83	
24-11-00	22	May 15/87	
24-11-00	23	Jun 15/80	
24-11-00	24	May 15/87	
24-11-00	25/26	Mar 15/83	
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24-11-00	108	Dec 15/91	
24-11-00	109	Dec 15/91	
24-11-00	110	Dec 15/91	
24-11-00	111/112	Nov 15/87	
24-11-00	113/114	Jul 15/83	
24-11-00	115	Jul 15/83	
24-11-00	116	Jul 15/83	
24-11-00	117/118	Jul 15/83	
R 24-11-01	201	Dec 15/95	
R 24-11-01	202	Dec 15/95	
R 24-11-01	203	Dec 15/95	
R 24-11-01	204	Dec 15/95	
R 24-11-01	205	Dec 15/95	
R 24-11-01	206	Dec 15/95	
24-11-01	207/208	May 15/86	
24-11-01	301	Mar 15/84	
24-11-01	302	Nov 15/84	
24-11-01	303	May 15/82	
24-11-01	304	May 15/82	
24-11-01	305	Nov 15/84	
24-11-01	306	Nov 15/84	
24-11-01	401	May 15/86	
24-11-01	402	Nov 15/82	
24-11-01	403	Dec 15/93	
24-11-01	404	Dec 15/93	
24-11-01	405	Dec 15/91	
24-11-01	406	Mar 15/81	
24-11-01	407	Aug 15/81	
24-11-01	408	Dec 15/93	
24-11-01	409	Jun 15/94	
24-11-01	410	Dec 15/93	
24-11-01	411	Dec 15/93	
24-11-01	412	Dec 15/93	

CHAPTER/ SECTION	PAGE	DATE	CONFIG CODE
24-11-01	413/414	Dec 15/93	
24-11-01	501	Nov 15/83	
24-11-01	502	May 15/90	
24-11-01	503	Nov 15/83	
24-11-01	504	Nov 15/83	
24-11-01	505	May 15/88	
24-11-01	506	May 15/85	
24-11-01	601	May 15/88	
24-11-01	602	Mar 15/84	
24-11-01	603	Mar 15/84	
24-11-01	604	Mar 15/84	
24-11-01	605	Mar 15/84	
24-11-01	606	Mar 15/84	
24-11-02	401	Nov 15/86	
24-11-02	402	Nov 15/86	
24-11-02	403	Nov 15/86	
24-11-02	404	Nov 15/86	
24-11-02	405	Nov 15/86	
24-11-02	406	Nov 15/86	
24-11-03	401	Nov 15/86	
24-11-03	402	Aug 15/81	
24-11-03	403	Aug 15/81	
24-11-03	404	Nov 15/86	
24-11-04	401	Nov 15/86	
24-11-04	402	Aug 15/81	
24-11-04	403	Aug 15/81	
24-11-04	404	Nov 15/86	
24-11-05	401	Nov 15/86	
24-11-05	402	Nov 15/86	
24-11-05	403	Nov 15/86	
24-11-05	404	Nov 15/86	
24-11-06	401	Nov 15/86	
24-11-06	402	Nov 15/86	
24-11-06	403	Aug 15/81	
24-11-06	404	Nov 15/86	
24-11-06	405/406	Nov 15/86	
24-11-07	401	Nov 15/86	
24-11-07	402	Nov 15/86	
24-11-07	403	Nov 15/86	
24-11-07	404	Nov 15/86	
24-11-07	405/406	Nov 15/86	
24-11-08	401	Mar 15/91	
24-11-08	402	Mar 15/91	
24-11-08	403	Mar 15/91	
24-11-08	404	Mar 15/91	
24-11-08	405	Mar 15/91	
24-11-08	406	Dec 15/91	
24-11-08	407	Mar 15/91	
24-11-08	408	Mar 15/91	
24-11-08	409	Mar 15/91	
24-11-08	410	Mar 15/91	
24-11-10	501	Jul 15/84	
24-11-10	502	Jul 15/84	
24-11-11	401	Mar 15/80	
24-11-11	402	Nov 15/74	
24-11-16	401	Nov 15/82	
24-11-16	402	Mar 15/84	
24-11-18	401	Mar 15/83	
24-11-18	402	Mar 15/83	
24-11-18	403	Mar 15/83	
24-11-18	404	Mar 15/83	
24-11-19	401	May 15/86	
24-11-19	402	May 15/86	
24-11-19	403	May 15/86	
24-11-19	404	May 15/86	
24-11-19	405	May 15/86	
24-11-19	406	May 15/86	
24-11-19	407	May 15/86	
24-11-19	408	May 15/86	
24-14-00	1	Dec 1/71	
24-14-00	2	Mar 15/80	
24-14-00	3/4	Mar 15/73	
24-14-00	5	Feb 15/74	
24-14-00	6	Mar 15/80	
24-14-00	7/8	Feb 15/74	
24-14-00	101	Dec 15/91	
24-14-00	102	Mar 15/81	
24-14-00	103	Mar 15/81	
24-14-00	104	May 15/87	
24-14-00	105	May 15/87	
24-14-00	106	May 15/87	
24-14-00	107	May 15/87	
24-14-00	108	May 15/87	
24-14-00	109/110	May 15/87	
24-14-02	401	Feb 15/74	
24-14-02	402	Feb 15/74	
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24-14-03	401	Feb 15/73	
24-14-03	402	Dec 15/94	
24-14-03	403/404	Dec 15/94	
24-14-04	401	Feb 15/73	
24-14-04	402	Dec 15/94	
24-14-04	403/404	Dec 15/94	
24-14-07	401	Feb 15/73	
24-14-07	402	Mar 15/80	
24-20-00	1/2	May 15/82	

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24-20-00	503	May 15/85	
24-20-00	504	May 15/85	
24-20-00	505	May 15/85	
24-20-00	506	May 15/85	
24-20-00	507	May 15/85	
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24-20-01	113/114	Mar 15/81	
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24-20-01	402	Nov 15/86	
24-20-03	401	Nov 15/82	
24-20-03	402	May 15/85	
24-21-00	1	May 15/82	
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24-21-00	3	May 15/82	
24-21-00	4	May 15/82	
24-21-00	5	Aug 15/82	
24-21-00	6	May 15/88	
24-21-00	7/8	May 15/82	
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24-21-00	11	May 15/88	
24-21-00	12	May 15/88	
24-21-00	13/14	May 15/82	
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24-21-00	28	May 15/88	
24-21-00	29	Dec 15/92	
24-21-00	30	May 15/88	
24-21-00	31	May 15/88	
24-21-00	32	May 15/88	
24-21-00	33	May 15/88	
24-21-00	34	Jul 15/83	
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24-21-00	36	May 15/88	
24-21-00	37	May 15/82	
24-21-00	38	May 15/82	
24-21-00	39	Jul 15/83	
24-21-00	40	Jul 15/83	
24-21-00	41/42	Mar 15/84	
24-21-00	43	Jul 15/83	
24-21-00	44	May 15/82	
24-21-00	45/46	Jul 15/83	
24-21-00	47/48	May 15/82	
24-21-00	101	Aug 15/82	
24-21-00	102	Mar 15/81	
24-21-00	103	Mar 15/81	
24-21-00	104	Feb 15/82	
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24-21-00	106	Feb 15/82	
24-21-00	107	May 15/85	
24-21-00	108	Jun 15/92	
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24-21-00	121	Mar 15/81	
24-21-00	122	Mar 15/81	
24-21-00	123	Mar 15/81	
24-21-00	124	Mar 15/81	
24-21-00	125/126	Mar 15/84	
24-21-00	127/128	Mar 15/84	
24-21-00	129/130	Mar 15/84	
24-21-00	131/132	Mar 15/84	
24-21-00	133/134	Mar 15/84	
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24-21-00	137/138	Mar 15/84	
24-21-00	139/140	Mar 15/84	

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24-21-00	145/146	Mar 15/84	
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24-21-00	151/152	Mar 15/84	
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24-21-00	155/156	Mar 15/84	
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24-21-00	159/160	May 15/90	
24-21-00	161/162	May 15/90	
24-21-00	163/164	May 15/90	
24-21-00	165/166	Mar 15/84	
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24-21-00	201	Jun 15/80	
24-21-00	202	Jun 15/80	
24-21-00	203	Aug 15/81	
24-21-00	204	Aug 15/81	
24-21-01	201/202	Aug 15/81	
24-21-01	501/502	Nov 15/78	
24-21-05	401	May 15/82	
24-21-05	402	May 15/85	
24-21-05	403/404	May 15/85	
24-21-07	201/202	Aug 15/81	
24-21-07	401	May 15/82	
24-21-07	402	May 15/82	
24-21-07	403/404	Aug 1/72	
24-21-07	405	May 15/82	
24-21-07	406	Dec 15/92	
24-21-07	407/408	Dec 15/80	
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24-24-00	3/4	Nov 15/75	
24-24-00	201	Nov 15/73	
24-24-00	202	Nov 15/73	
24-24-00	203	Mar 15/80	
24-24-00	204	Mar 15/80	
24-24-01	301	May 15/87	
24-24-01	302	May 15/76	
24-24-01	303/304	May 15/87	
24-24-01	401	May 15/87	
24-24-01	402	May 15/86	
24-24-01	403	May 15/74	
24-24-01	404	Feb 15/73	
24-24-01	405	Nov 15/86	
24-24-01	406	Nov 15/86	
24-24-01	407/408	May 15/86	
24-24-01	601	May 15/88	
24-24-01	602	May 15/88	
24-24-04	201	Aug 15/81	
24-24-04	202	Aug 15/81	
24-24-04	401	May 15/82	
24-24-04	402	May 15/82	
24-24-04	403/404	Aug 1/72	
24-24-04	405/406	May 15/82	
24-24-04	407/408	Dec 15/80	
24-30-00	1/2	May 15/75	
24-31-00	1	Sep 15/80	
24-31-00	2	May 15/82	
24-31-00	3/4	Dec 15/80	
24-31-00	5/6	Nov 15/81	
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24-31-00	10	Dec 15/79	
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24-31-00	13/14	Nov 15/81	
R 24-31-00	101	Dec 15/95	
R 24-31-00	102	Dec 15/95	
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24-31-00	116	Nov 15/81	
24-31-00	117	Aug 15/82	
24-31-00	118	Nov 15/81	
24-31-00	119/120	Nov 15/81	
24-31-00	121/122	Nov 15/81	
24-31-00	123/124	May 15/88	
24-31-00	125/126	Nov 15/81	
24-31-00	501	Mar 15/84	
24-31-00	502	Nov 15/82	
24-31-00	503/504	Nov 15/82	
24-31-01	401	Aug 15/81	
24-31-01	402	Aug 1/72	
24-31-01	403/404	Nov 15/77	

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24-31-05	302	Mar 15/80	
24-31-06	301	Mar 15/83	
24-31-06	302	Mar 15/83	
24-31-12	401	Nov 15/86	
24-31-12	402	Aug 15/78	
24-32-00	1	Nov 15/88	
24-32-00	2	Nov 15/88	
24-32-00	3/4	Dec 15/80	
24-32-00	5/6	Nov 15/85	
24-32-00	7/8	Jun 15/92	
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24-32-00	116	Nov 15/85	
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24-32-00	118	May 15/86	
24-32-00	119/120	May 15/86	
24-32-00	121/122	May 15/90	
24-32-00	123/124	Dec 15/91	
24-32-00	125/126	May 15/86	
24-32-00	127/128	May 15/90	
24-32-00	129/130	Nov 15/89	
24-32-00	131/132	May 15/86	
24-32-00	501	Dec 15/91	
24-32-00	502	Nov 15/85	
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24-32-00	504	Nov 15/89	
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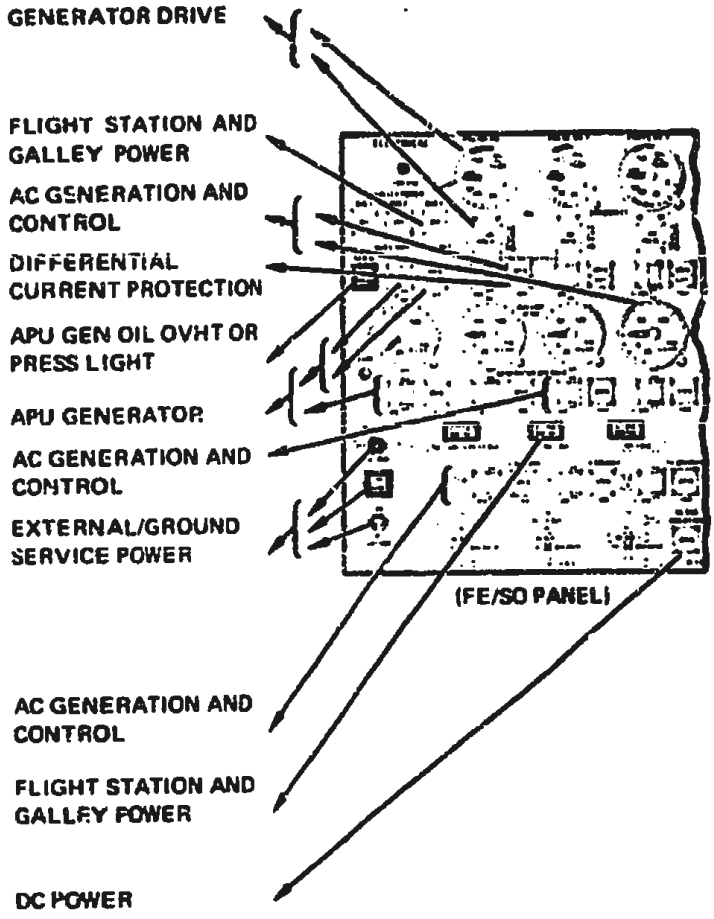

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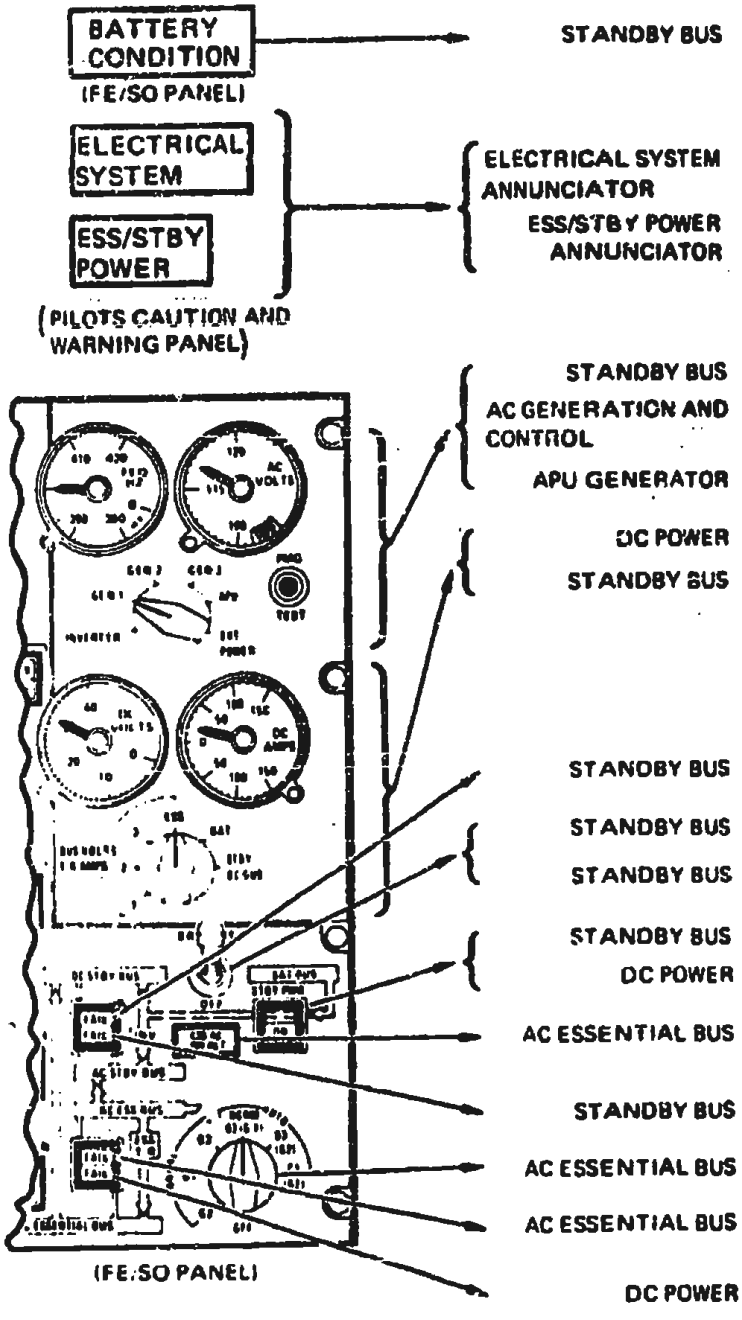

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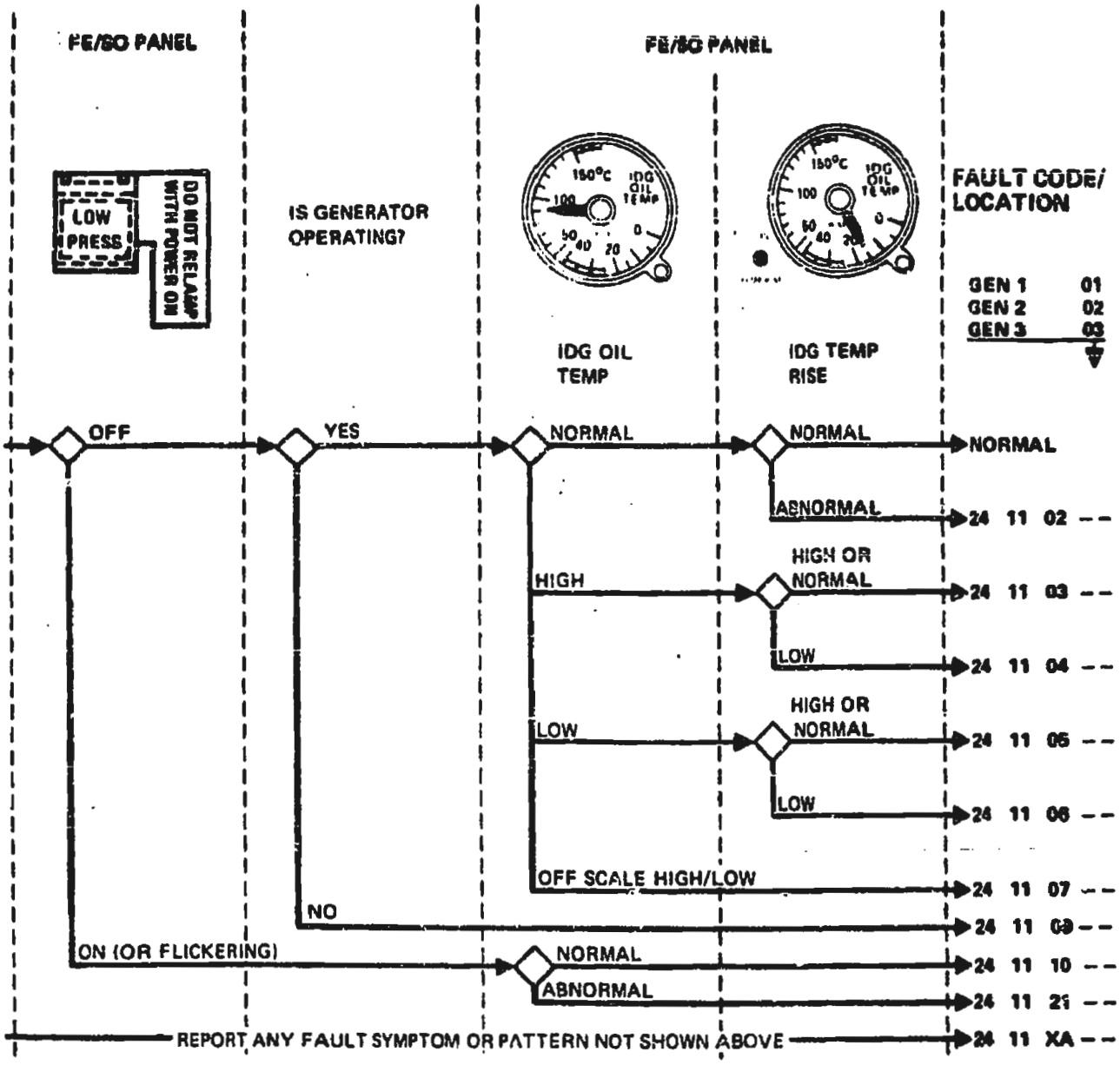

APPLICABLE CIRCUIT BREAKERS

3D10	BUS 1	3D16	BUS 3
3D13	BUS 2	3G16	ELECTRIC METER SWITCH

(ADDITIONAL CIRCUIT BREAKERS ON GENERATOR CONTROL UNITS IN MID ELECTRICAL SERVICE CENTER)

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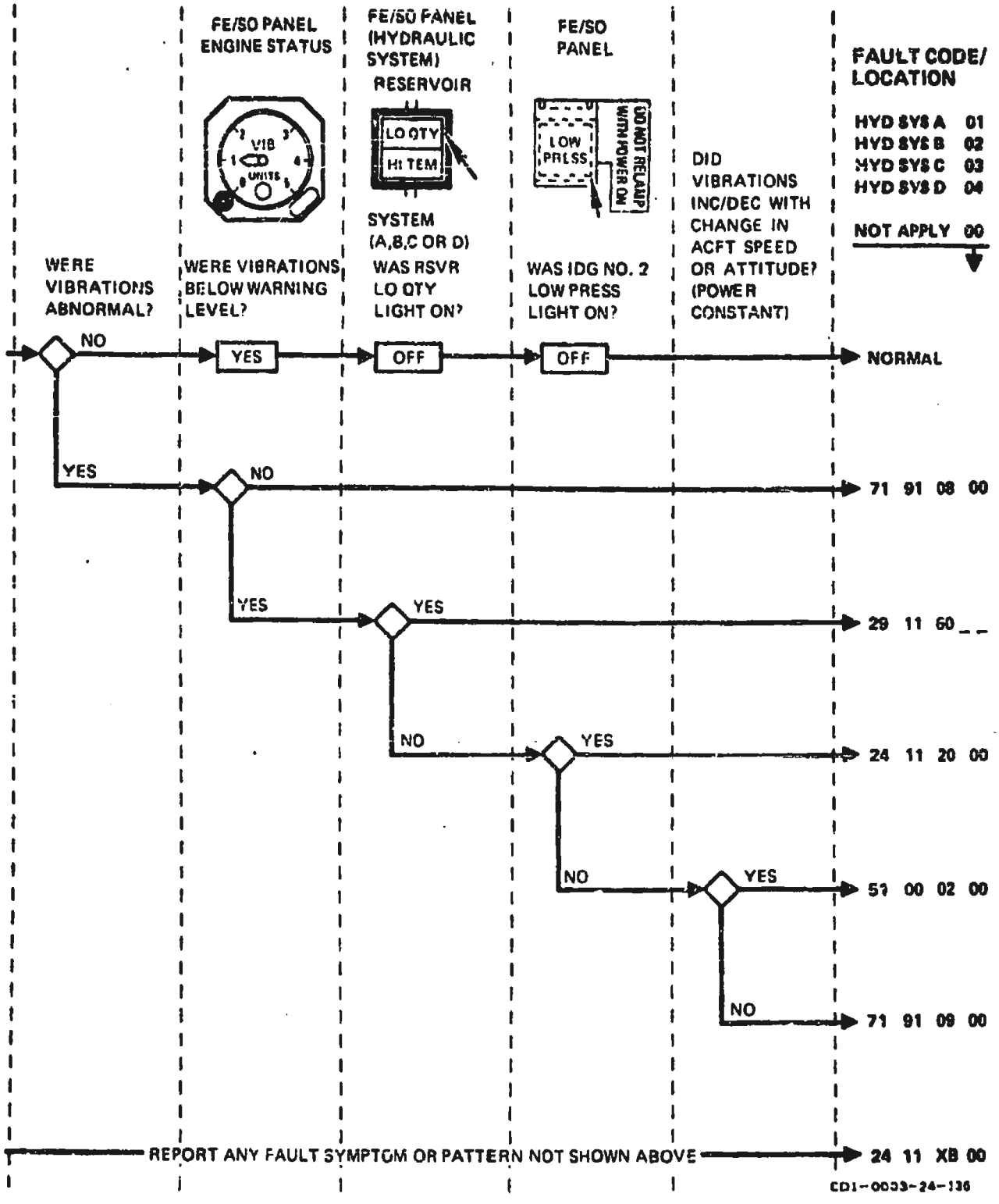
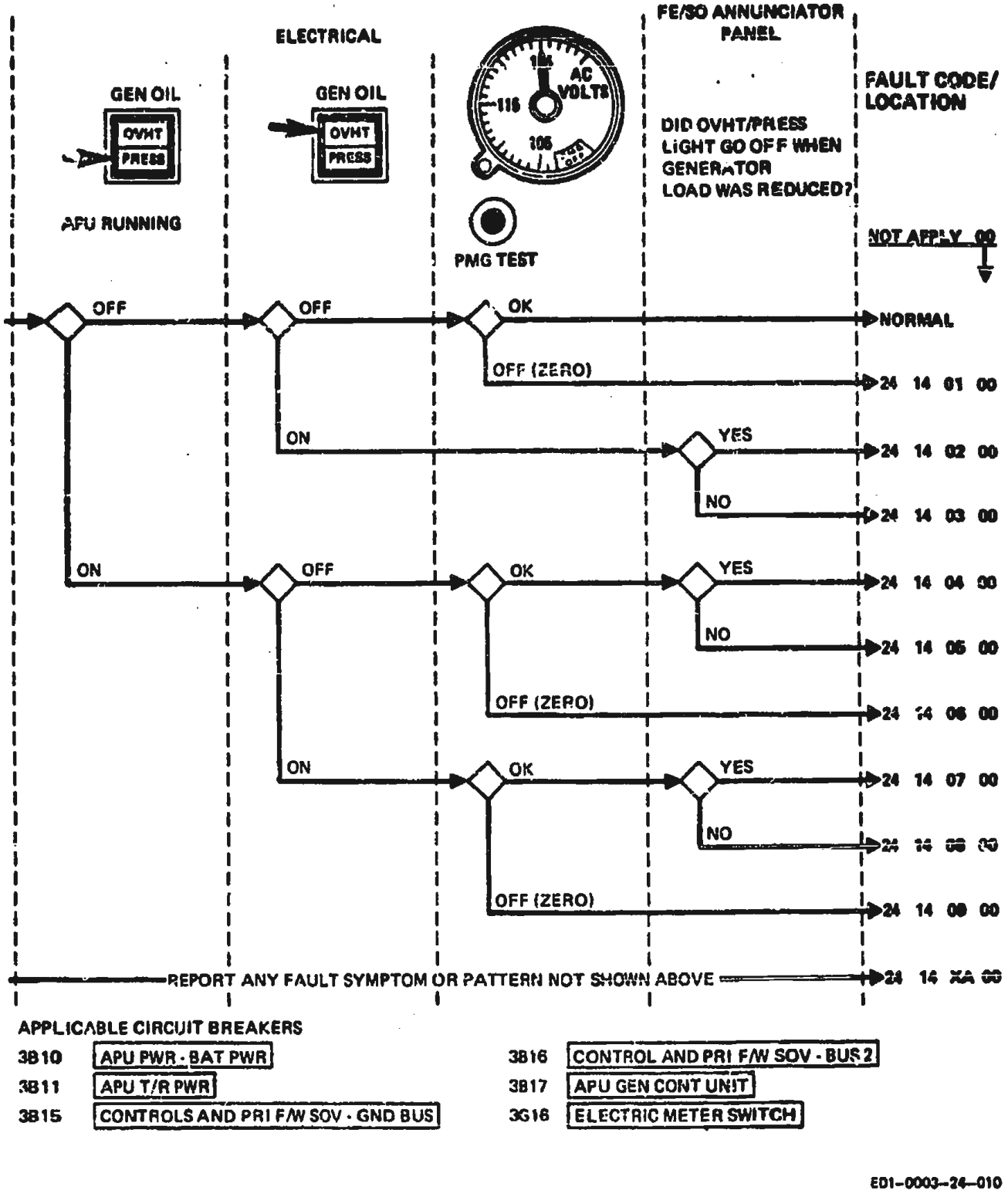
R Generator Drive - Fault Codes
Figure 1

EFFECTIVITY: ALL

24-FAULT CODE DIAGRAM

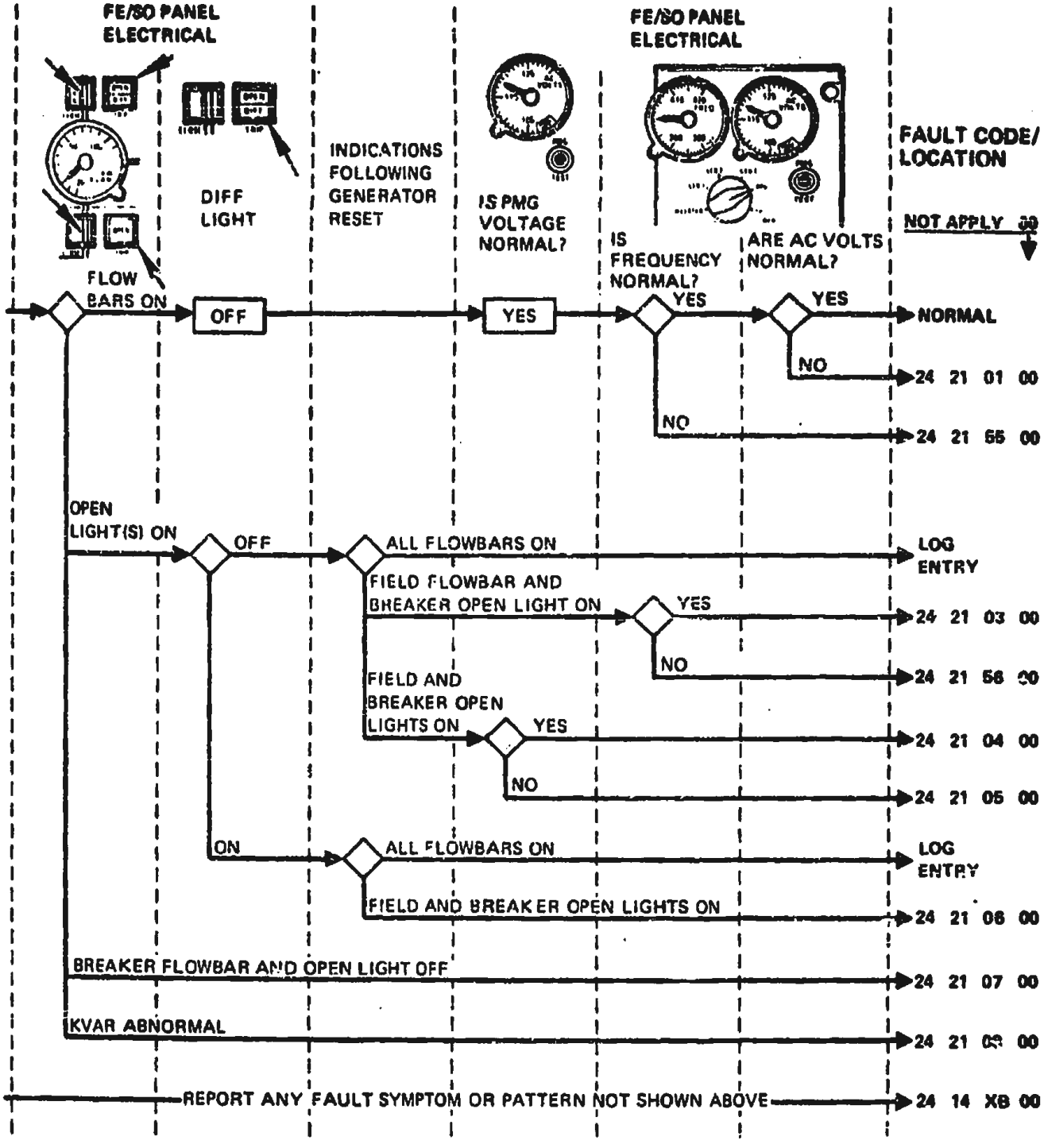


R Aft Cabin Vibration - Fault Codes
Figure 2



ED1-0003-24-010

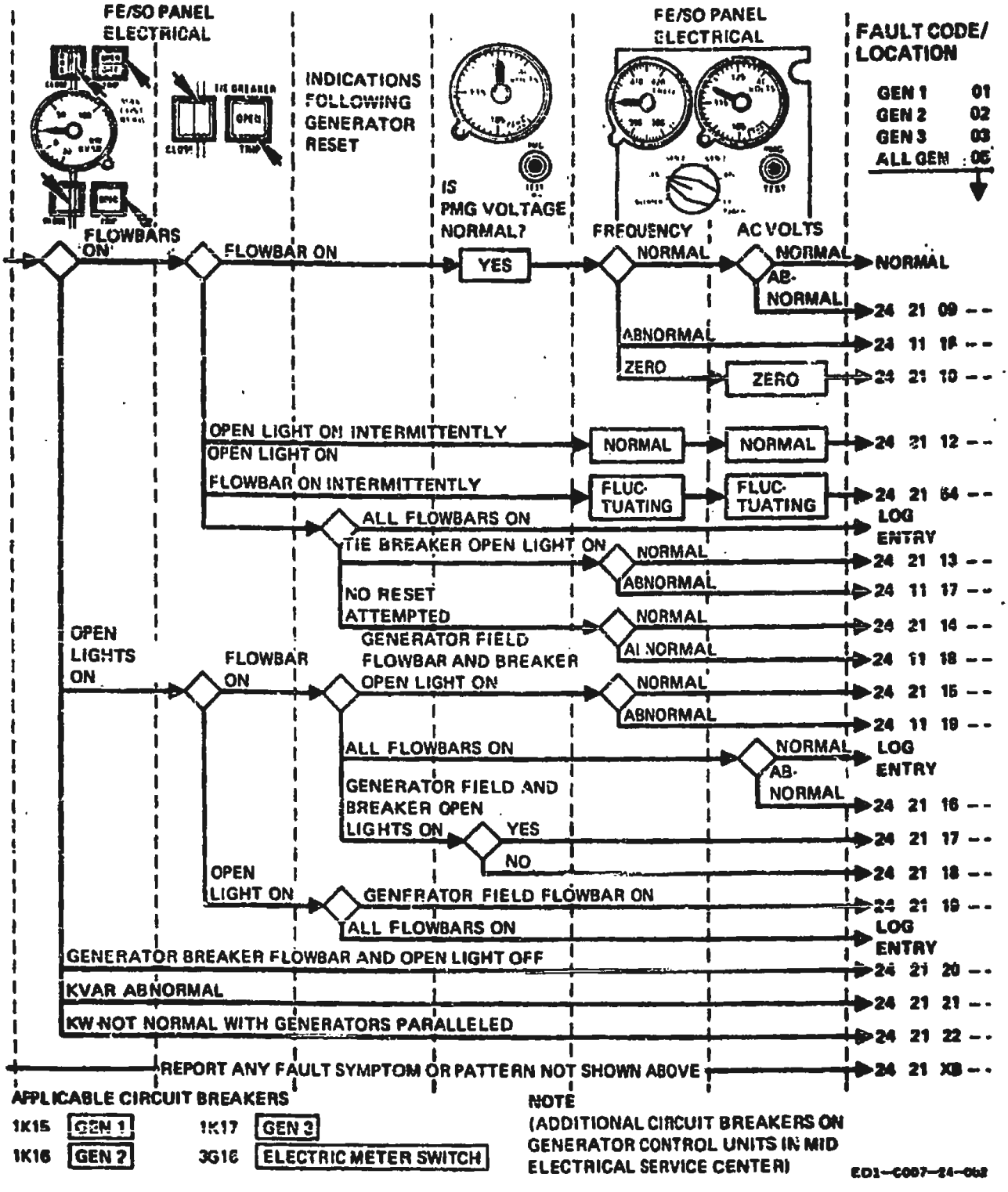
APU Gen Oil OVHT or PRESS Light - Fault Codes
Figure 3



R APU Generator - Fault Codes
Figure 4

EFFECTIVITY: ALL

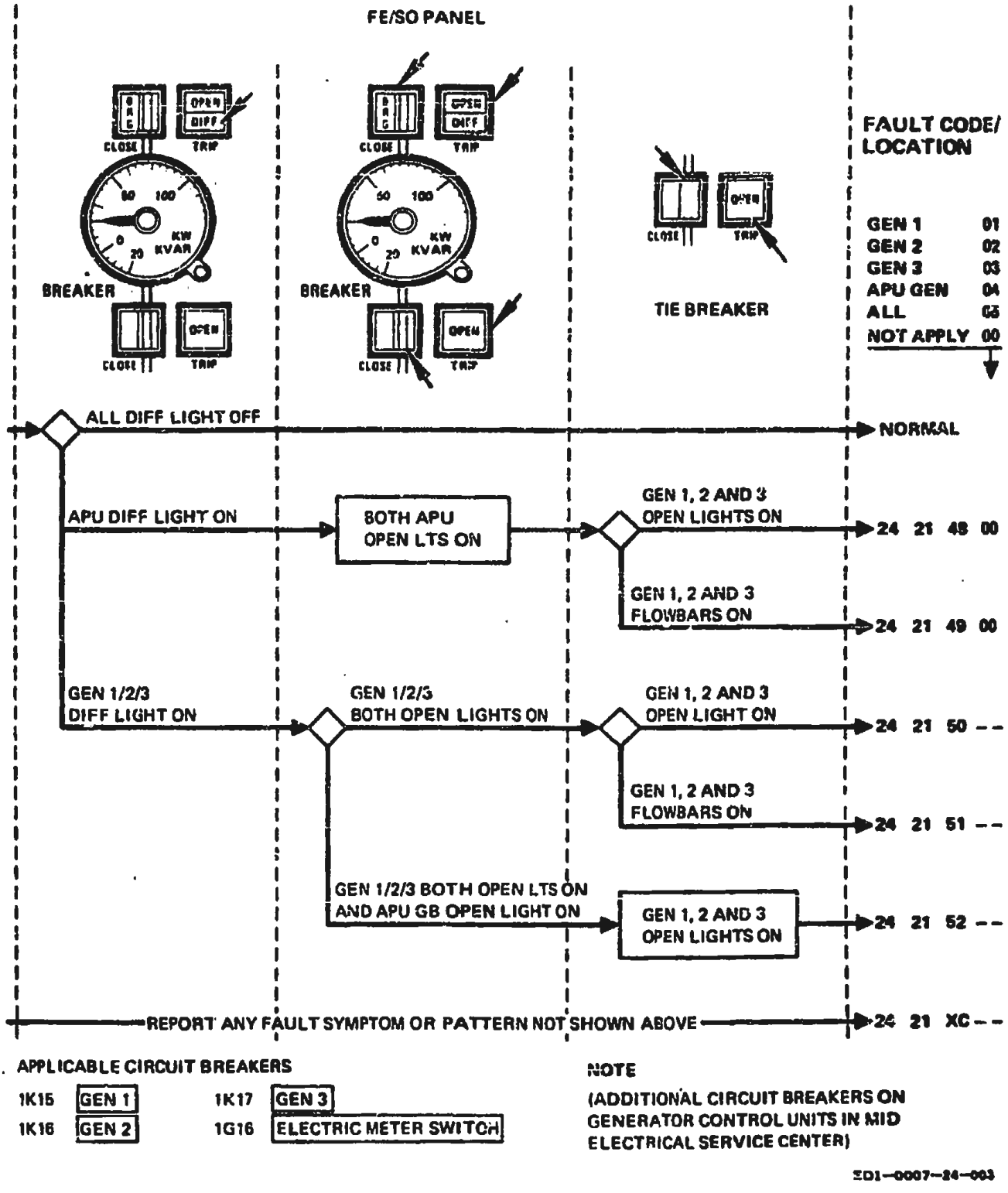
24-FAULT CODE DIAGRAM



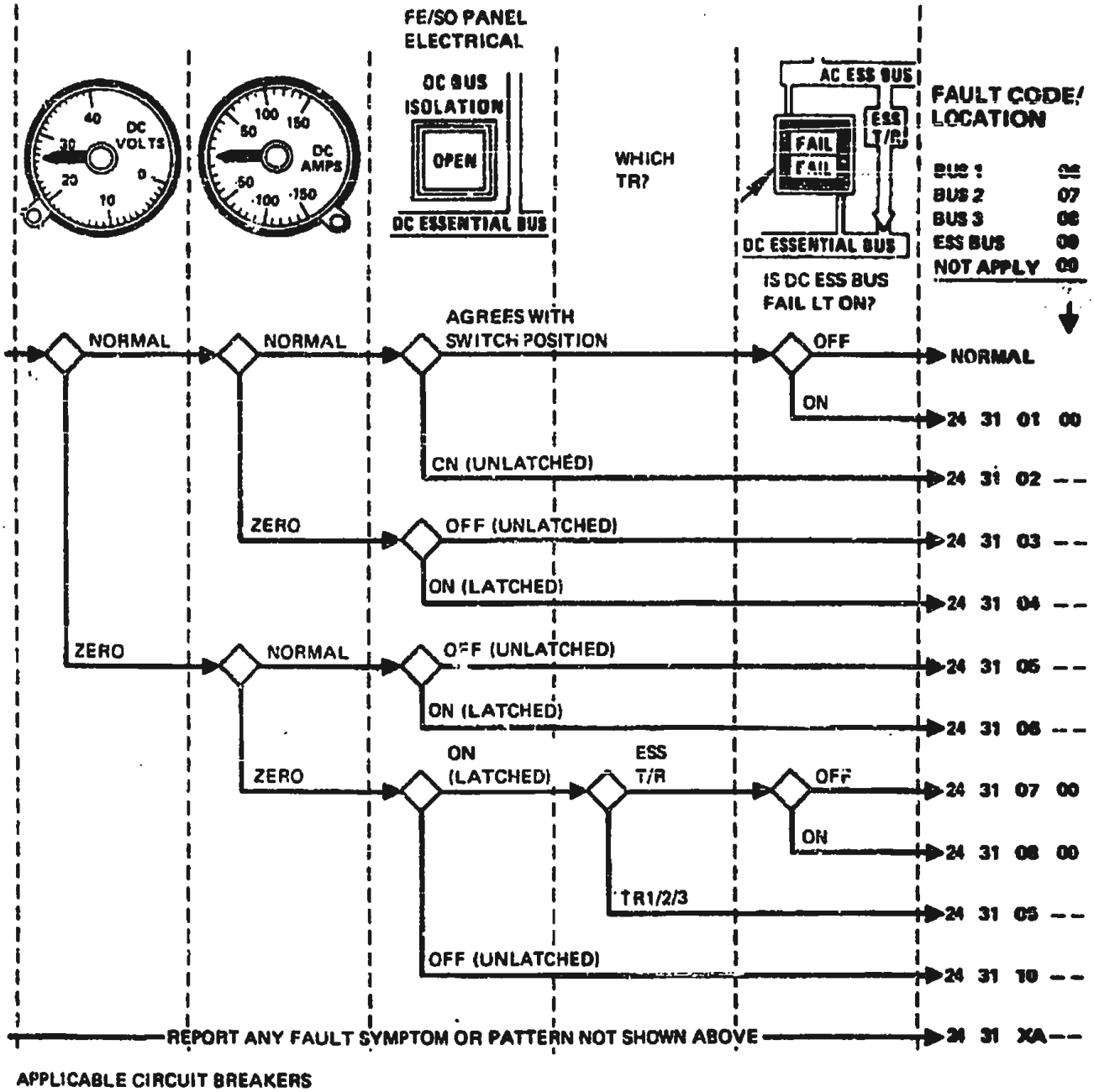
R AC Generation and Control - Fault Codes
Figure 5

EFFECTIVITY: ALL

24-FAULT CODE DIAGRAM


FE/SO PANEL
BREAKER
BREAKER
TIE BREAKER
FAULT CODE/ LOCATION
GEN 1 01
GEN 2 02
GEN 3 03
APU GEN 04
ALL 05
NOT APPLY 00
ALL DIFF LIGHT OFF
NORMAL
APU DIFF LIGHT ON
BOTH APU OPEN LTS ON
GEN 1, 2 AND 3 OPEN LIGHTS ON
24 21 48 00
GEN 1, 2 AND 3 FLOWBARS ON
24 21 49 00
GEN 1/2/3 DIFF LIGHT ON
GEN 1/2/3 BOTH OPEN LIGHTS ON
GEN 1, 2 AND 3 OPEN LIGHT ON
24 21 50 --
GEN 1, 2 AND 3 FLOWBARS ON
24 21 51 --
GEN 1/2/3 BOTH OPEN LTS ON AND APU GB OPEN LIGHT ON
GEN 1, 2 AND 3 OPEN LIGHTS ON
24 21 52 --
REPORT ANY FAULT SYMPTOM OR PATTERN NOT SHOWN ABOVE
24 21 XC --
APPLICABLE CIRCUIT BREAKERS
1K15 GEN 1
1K16 GEN 2
1K17 GEN 3
1G16 ELECTRIC METER SWITCH
NOTE
(ADDITIONAL CIRCUIT BREAKERS ON GENERATOR CONTROL UNITS IN MID ELECTRICAL SERVICE CENTER)
ED1-0007-24-003

Differential Current Protection - Fault Codes
Figure 6



APPLICABLE CIRCUIT BREAKERS

1K13	DC STBY IND	1K17	GEN 3	3A10	TIE BUS CONT	BUS 2
1K15	GEN 1	3G16	ELECTRIC METER SWITCH	3A11	TIE BUS CONT	BUS 3
1K16	GEN 2	3A9	TIE BUS CONT BUS 1	3F12	DC TIE BUS	CONT

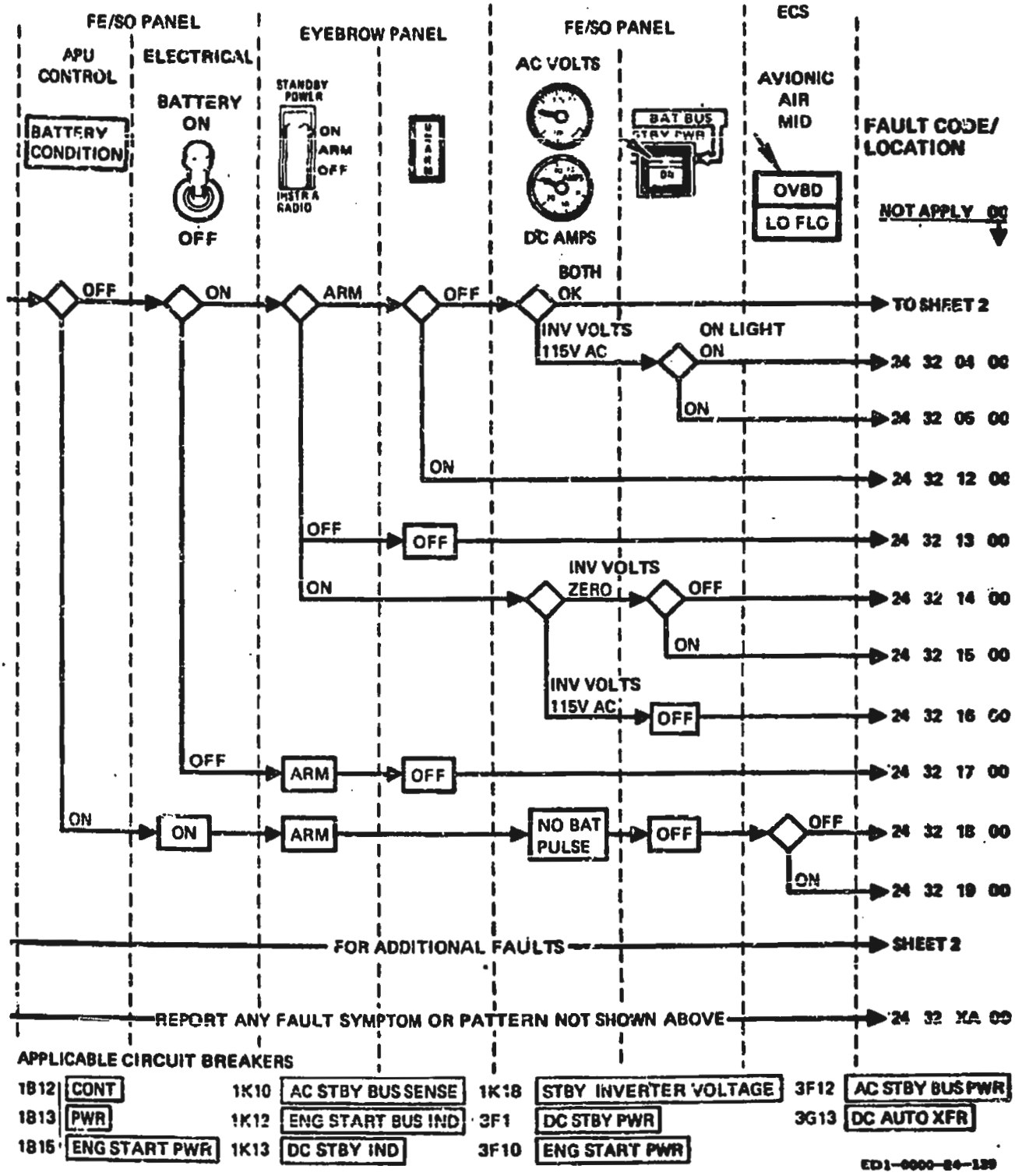
ED1-0007-24-004

R

DC Power - Fault Codes
Figure 7

EFFECTIVITY: ALL

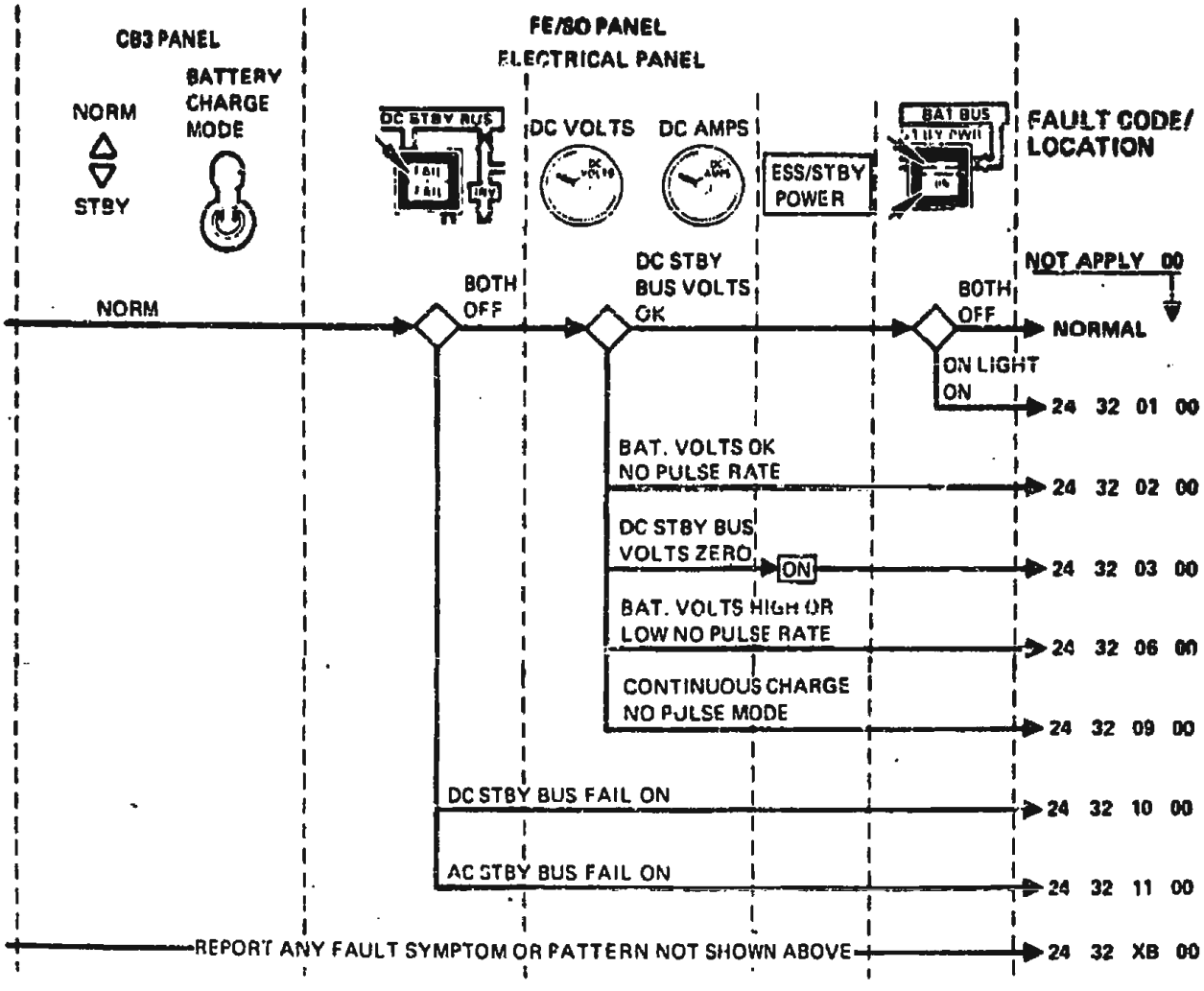
24-FAULT CODE DIAGRAM



R Standby Bus (Sheet 1) - Fault Codes
Figure 8

R EFFECTIVITY: ALL

050B



APPLICABLE CIRCUIT BREAKERS

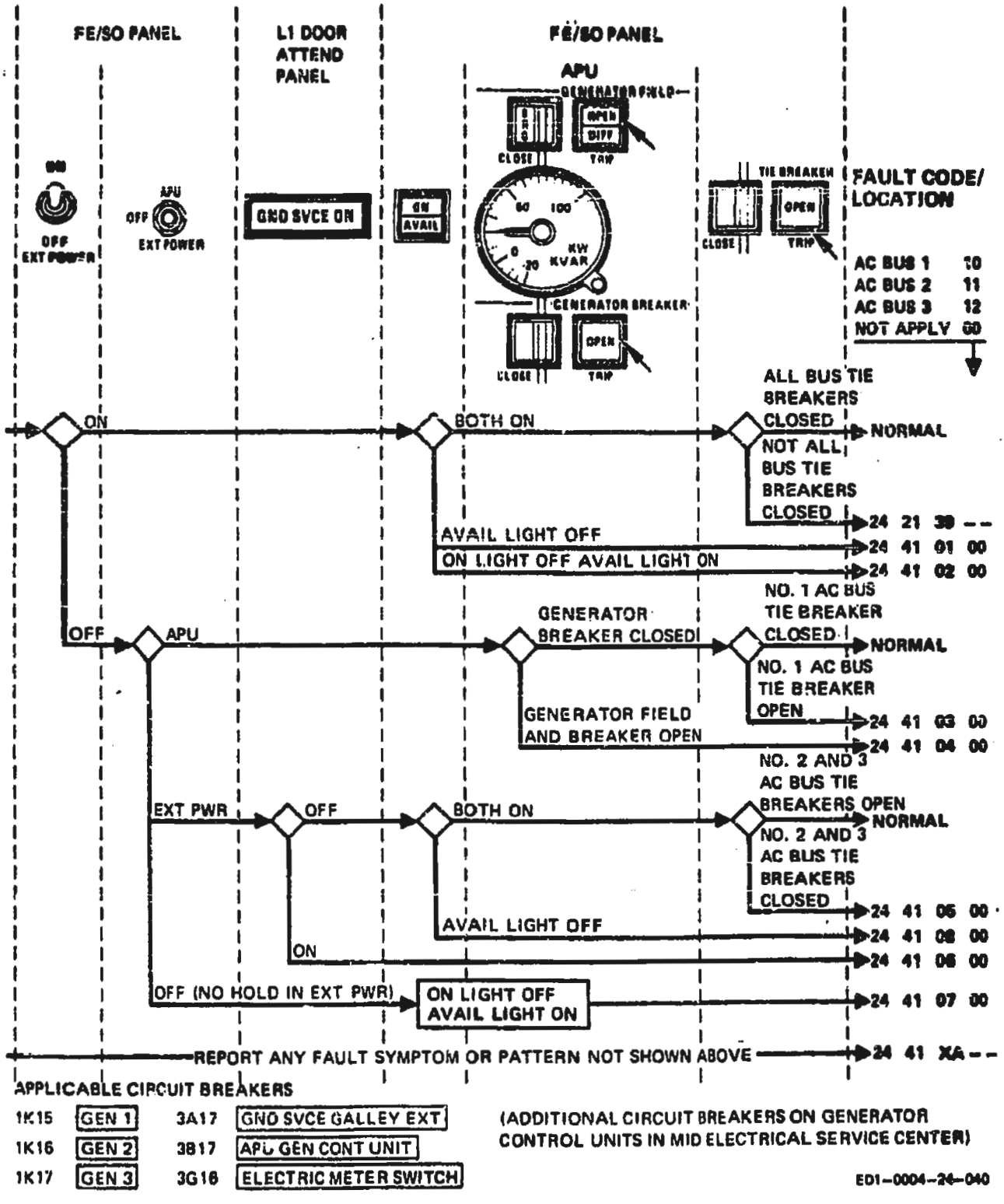
1B12	CONT	1K10	AC STBY BUS SENSE	1K18	STBY INVERTER VOLTAGE	3F12	AC STBY BUS PWR
1B13	PWR	1K12	ENG START BUS IND	3F1	DC STBY PWR	3G13	DC AUTO XFR
1B15	ENG START PWR	1K13	DC STBY IND	3F10	ENG START PWR		

NOTE

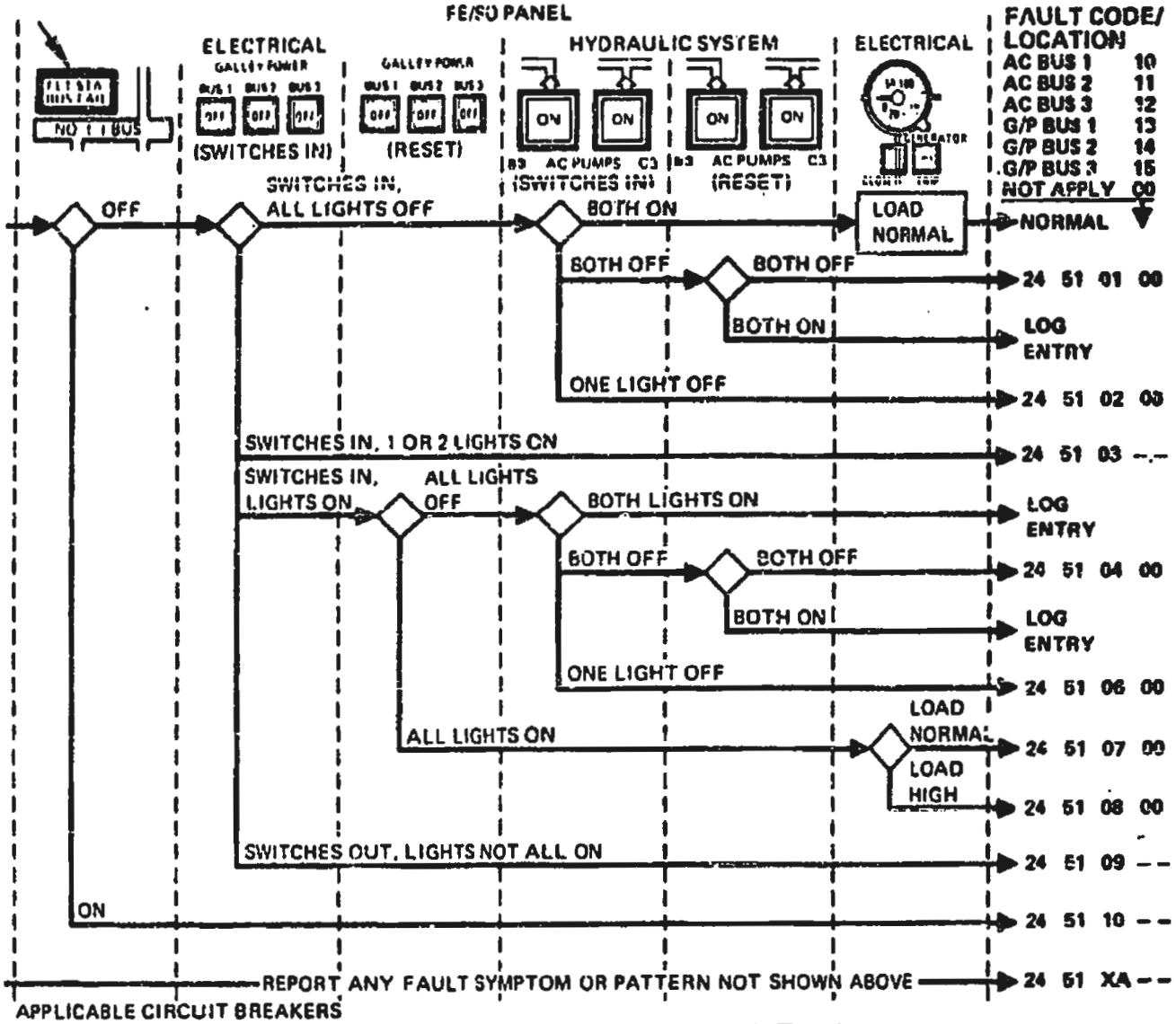
MANY FACTORS CAN CAUSE A HIGH PULSE RATE; BATTERY CONDITION, BATTERY TEMPERATURE, PREVIOUS LOAD USED. THEREFORE, PULSE RATE SHOULD NOT BE USED TO MONITOR SYSTEM PERFORMANCE. PULSE RATE WILL USUALLY FALL BETWEEN 5 AND 30 SECONDS.

EDI-0002-24-137

R Standby Bus (Sheet 2) - Fault Codes
Figure 9



External/Ground Service Power - Fault Codes
Figure 10



APPLICABLE CIRCUIT BREAKERS

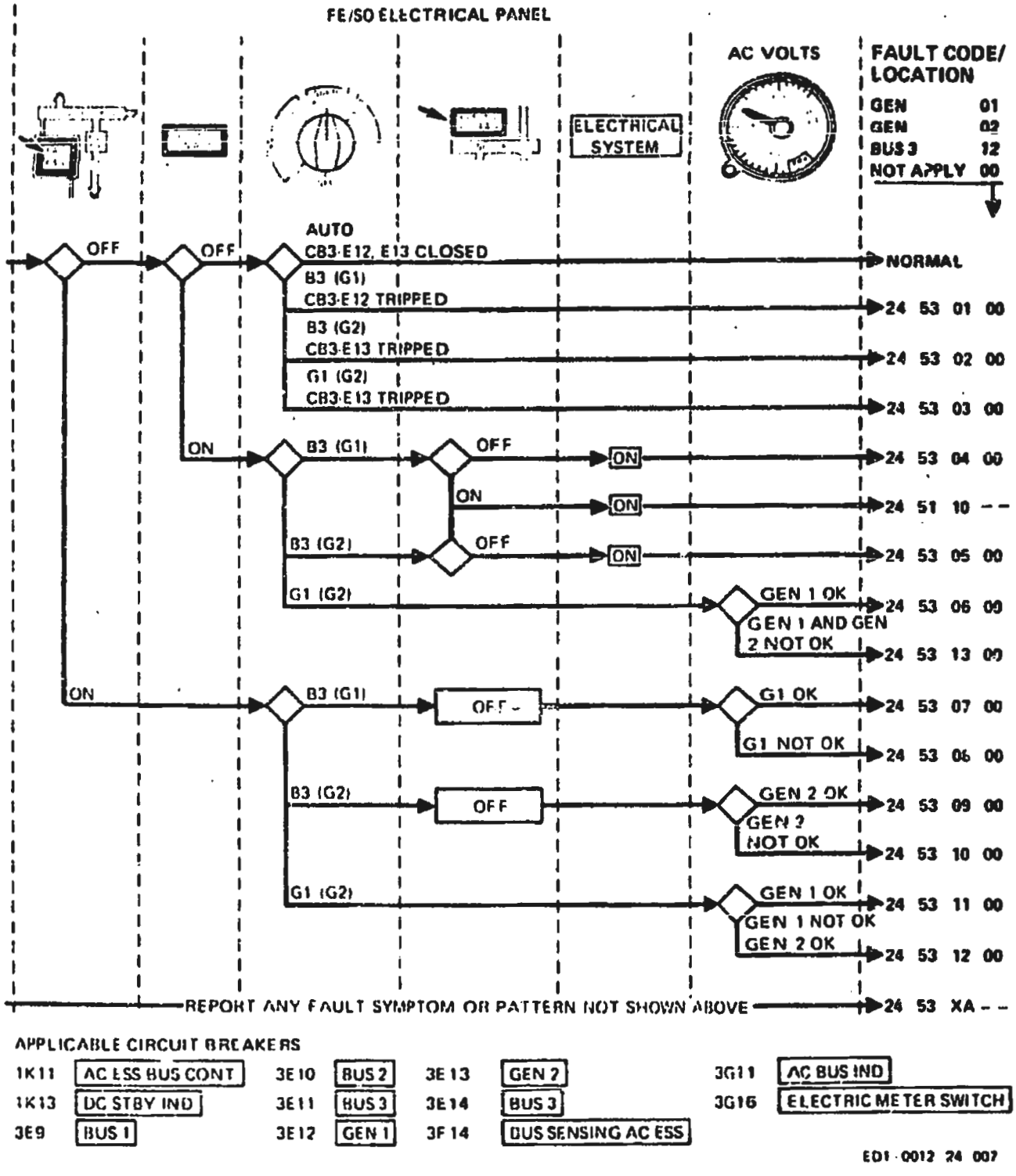
2L10	AC HYD	MOTOR	IND	GALLEY LEFT 6C	GALLEY	CONT	BUS 3
2L12	AC	PUMP	B3	GALLEY LEFT 7C	GALLEY	CONT	BUS 2
2L22	AC	PUMP	C3	GALLEY LEFT 17B	GALLEY	CONT	BUS 1
3D10	LOAD CONT & FAIL IND	BUS 1		GALLEY RIGHT 16E	OVEN 1		
3D13	LOAD CONT & FAIL IND	BUS 2		GALLEY RIGHT 17E	OVEN 2		
3D16	LOAD CONT & FAIL IND	BUS 3		GALLEY RIGHT 18E	OVEN 3		
3E9	FLIGHT STA PWR	BUS 1		GALLEY RIGHT 18F	GALLEY POWER	BUS 1	
3E10	FLIGHT STA PWR	BUS 2		GALLEY RIGHT 19E	OVEN 4		
3E11	FLIGHT STA PWR	BUS 3		GALLEY RIGHT 19F	GALLEY POWER	BUS 2	
3G11	IND LT	AC BUS		GALLEY RIGHT 20E	OVEN 5		
3G14	GEN	OVERLOAD	PROTECT	GALLEY RIGHT 20F	GALLEY POWER	BUS 3	

ED1-0009-24-008

R Flight Station and Galley Power - Fault Codes
Figure 11

R EFFECTIVITY: ALL

R 0508



R

AC Essential Bus - Fault Codes
Figure 12

EFFECTIVITY: ALL

050B

24-FAULT CODE DIAGRAM

FAULT CODE INDEX
TABLE 1

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	24 11 XA __	1. A Generator Drive fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 24-11-00 Fig. 103, 104, 105, 106 BLock 1
	24 11 XB 00	1. An Aft Cabin Vibration fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 24-11-00 Fig. 106 Block 1
	24 14 XA 00	1. An APU Gen Oil OVHT or PRESS Light fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 24-14-00 Fig. 103, 104 Block 1
	24 14 XB 00	1. An APU Generator fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 24-14-00 Fig. 103, 104 Block 1
	24 21 XB __	1. An AC Generation and Control fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 24-21-00 Fig. 105 thru 113 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 21 XC __	1. A Differential Current Protection fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 24-21-00 Fig. 112 Block 1
24 31 XA __	1. A DC Power fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 24-31-00 Fig. 103 thru 107 Block 1
24 32 XA 00	1. A Standby Bus fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 24-32-00 Fig. 103 thru 107 Block 1
R 24 32 XB 00	1. A Standby Bus fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R	2. 24-32-00 Fig. 103 thru 107 Block 1
24 41 XA __	1. An External/Ground Service Power fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
	2. 24-41-00 Fig. 103, 104, 105 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	24 51 XA __	1. A Flight Station and Galley Power fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 24-51-00 Fig. 103, 104, 105 Block 1
	24 53 XA __	1. An AC Essential Bus fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
		2. 24-53-00 Fault Isolation
	24 11 01 00	1. NOT USED.
	24 11 02 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) IDG TEMP rise abnormal. IDG OIL TEMP normal.
R		2. 24-11-00 Fig. 105 Block 1
	24 11 03 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) IDG OIL TEMP high. IDG OIL TEMP rise normal or high.
R		2. 24-11-00 Fig. 105 Block 1
	24 11 04 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) IDG OIL TEMP high. IDG OIL TEMP rise low.
R		2. 24-11-00 Fig. 105 Block 1
	24 11 05 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) IDG OIL TEMP low. IDG OIL TEMP rise normal or high.
R		2. 24-11-00 Fig. 105 Block 1
	24 11 06 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) IDG OIL TEMP low. IDG OIL TEMP rise low.
R		2. 24-11-00 Fig. 105 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 11 07 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) IDG OIL TEMP off scale high or low. 2. 24-11-00 Fig. 105 Block 1
24 11 08 00	1. NOT USED.
24 11 09 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) LOW PRESS legend off; generator not operating. 2. 24-11-00 Fig. 104 Block 7
24 11 10 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) IDG LOW PRESS legend (on, or flickering). IDG OIL TEMP normal. 2. 24-11-00 Fig. 104 Block 1
24 11 11 00	1. NOT USED.
24 11 12 00	1. NOT USED.
24 11 13 00	1. NOT USED.
24 11 14 00	1. NOT USED.
24 11 15 00	1. NOT USED.
24 11 16 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) frequency abnormal (___Hz). System operation normal. 2. 24-11-00 Fig. 103 Block 3
24 11 17 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) tie breaker OPEN light(s) on, would not reset. Frequency abnormal(___Hz). 2. 24-11-00 Fig. 103 Block 3

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 11 18 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) tie breaker OPEN light(s) on. No reset attempted, frequency abnormal (___Hz).
	2. 24-11-00 Fig. 103 Block 3
24 11 19 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) (breaker, or breaker and field) OPEN light(s) on; tie breaker flowbar on. Generator reset; generator breaker OPEN light on, frequency abnormal.
	2. 24-11-00 Fig. 103 Block 3
24 11 20 00	1. IDG NO. 2 LOW PRESS light on, vibration in the aft cabin.
	2. 24-11-00 Fig. 106 Block 1
24 11 21 __	1. IDG LOW PRESS light on (or flickering), IDG OIL TEMP abnormal.
	2. 24-11-00 Fig. 104 Block 1
24 14 01 00	1. APU generator PMG AC volts off (zero). GEN OIL - PRESS light not on (APU running).
R	2. 24-14-00 Fig. 103 Block 9
24 14 02 00	1. APU GEN OIL - OVHT light came on. OVHT light off when generator load reduced.
R	2. 24-14-00 Fig. 104 Block 2
24 14 03 00	1. APU GEN OIL - OVHT light on. OVHT light remained on when generator load reduced.
R	2. 24-14-00 Fig. 104 Block 1
24 14 04 00	1. APU GEN OIL - PRESS light on. PRESS light off when generator load reduced.
R	2. 24-14-00 Fig. 103 Block 7

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	24 14 05 00	1. APU GEN OIL - PRESS light on. PMG AC volts ok. PRESS light not off when generator load reduced.
		2. 24-14-00 Fig. 103 Block 5
	24 14 06 00	1. APU GEN OIL - PRESS light on. PMG AC volts off (zero).
R		2. 24-14-00 Fig. 103 Block 5
	24 14 07 00	1. APU GEN OIL - PRESS and OVHT lights on. PMG AC volts ok. PRESS and OVHT lights off when generator load reduced.
R		2. 24-14-00 Fig. 103 Block 2
	24 14 08 00	1. APU GEN OIL - PRESS and OVHT lights on. PMG AC volts ok. Lights remained on when generator load reduced.
R		2. 24-14-00 Fig. 103 Block 1
	24 14 09 00	1. APU GEN OIL - PRESS and OVHT lights on. PMG AC volts off (zero).
R		2. 24-14-00 Fig. 103 Block 1
	24 21 01 00	1. APU generator AC volts abnormal, system operation normal.
		2. 24-21-00 Fig. 107 Block 1
	24 21 02 00	1. NOT USED.
	24 21 03 00	1. APU generator (breaker, or breaker and field) OPEN light(s) on; DIFF light off. Generator reset; generator breaker OPEN light on, frequency normal.
		2. 24-21-00 Fig. 106 (Sheet 1) Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 21 04 00	1. APU generator (breaker, or breaker and field) OPEN light(s) on; DIFF light off. Generator reset; OPEN light on, PMG voltage OK.
	2. 24-21-00 Fig. 106 (Sheet 1) Block 1
24 21 05 00	1. APU generator (breaker, or breaker and field) OPEN light(s) on, DIFF light off. Generator reset; OPEN lights on. PMG voltage abnormal.
	2. 24-21-00 Fig. 105 Block 1
24 21 06 00	1. APU generator (breaker, or breaker and field) OPEN light(s) on; DIFF light on. Generator reset, OPEN lights on.
	2. 24-21-00 Fig. 112B Block 1
24 21 07 00	1. APU generator breaker flowbar and OPEN light off.
	2. 24-21-00 Fig. 108 (Sheet 1) Block 4
24 21 08 00	1. APU generator KVAR abnormal.
	2. 24-21-00 Fig. 111 (Sheet 4) Block 2
24 21 09 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) AC volts abnormal, system normal.
	2. 24-21-00 Fig. 107 Block 1
24 21 10 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) frequency and voltage zero, all other indications normal.
	2. 24-21-00 Fig. 107 Block 4
24 21 11 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 21 12 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) tie breaker OPEN light intermittently on, frequency and AC volts normal.
	2. 24-21-00 Fig. 104 Block 10
24 21 13 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3, 05=All Gen) bus tie breaker OPEN light(s) on. Generator reset; tie breaker would not reset.
	2. 24-21-00 Fig. 111 (Sheet 1) Block 7
24 21 14 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) tie breaker OPEN light(s) on. No reset attempted, frequency normal.
	2. 24-21-00 Fig. 111 (Sheet 1) Block 7
24 21 15 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) breaker OPEN and field flowbar lights on; tie breaker flowbar on. Generator reset; generator breaker OPEN light on, frequency normal.
	2. 24-21-00 Fig. 108 Block 8
24 21 16 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) (breaker, or breaker and field) OPEN lights on; tie breaker flowbar on. Generator reset; flow bars on, voltage abnormal (___V).
	2. 24-21-00 Fig. 107 Block 1
24 21 17 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) breaker and field OPEN light(s) on; tie breaker flowbar on. Generator reset; OPEN lights on, PMG voltage OK.
	2. 24-21-00 Fig. 106 Block 8

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 21 18 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) (breaker, or breaker and field) OPEN light(s) on; tie breaker flowbar on. Generator reset; OPEN lights on, PMG voltage abnormal. 2. 24-21-00 Fig. 105 Block 1
24 21 19 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) (breaker, or breaker and field) OPEN light(s) on, bus tie breaker OPEN light on. Generator would not reset, OPEN light(s) remain on. 2. 24-21-00 Fig. 111 (Sheet 1) Block 7
24 21 20 __	1. (01=No. 1, 02=No. 2, 03=No. 3) generator breaker flowbar and OPEN light off. 2. 24-21-00 Fig. 108 (Sheet 1) Block 8
24 21 21 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) KVAR abnormal. ACFT log book report should also reflect KW for each gen. when paralleled, and volt/freq. of suspect gen. when isolated to own bus. 2. 24-21-00 Fig. 111 (Sheet 4) Block 2
24 21 22 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) KW not normal when generator paralleled (give actual reading). ACFT log book report should also reflect KW for each gen. when paralleled, and volt/freq. of suspect gen. when isolated to own bus. 2. 24-21-00 Fig. 111 (Sheet 3) Block 4
24 21 23 00	1. NOT USED.
24 21 24 00	1. NOT USED.
24 21 25 00	1. NOT USED.
24 21 26 00	1. NOT USED.
24 21 27 00	1. NOT USED.
24 21 28 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 21 29 00	1. NOT USED.
24 21 30 00	1. NOT USED.
24 21 31 00	1. NOT USED.
24 21 32 00	1. NOT USED.
24 21 33 00	1. NOT USED.
24 21 34 00	1. NOT USED.
24 21 35 00	1. NOT USED.
24 21 36 00	1. NOT USED.
24 21 37 00	1. NOT USED.
24 21 38 00	1. NOT USED.
24 21 39 __	1. (10=AC Bus 1, 11=AC Bus 2, 12=AC Bus 3) tie breaker would not close with external power on. 2. 24-21-00 Fig. 113 (Sheet 1) Block 5
24 21 40 00	1. NOT USED.
24 21 41 00	1. NOT USED.
24 21 42 00	1. NOT USED.
24 21 43 00	1. NOT USED.
24 21 44 00	1. NOT USED.
24 21 45 00	1. NOT USED.
24 21 46 00	1. NOT USED.
24 21 47 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 21 48 00	1. APU DIFF light on, generator field and breaker OPEN lights on. Generators No. 1, 2, and 3 bus tie breaker OPEN lights on. 2. 24-21-00 Fig. 112B Block 4
24 21 49 00	1. APU DIFF light on, generator field and breaker OPEN lights on. Generators No. 1, 2 and 3 flowbars on. 2. 24-21-00 Fig. 112B Block 6
24 21 50 __	1. (01=No. 1, 02=No. 2, 03=No. 3) generator DIFF light on. Generator field, breaker, and bus tie breaker OPEN lights on. 2. 24-21-00 Fig. 112A Block 2
24 21 51 __	1. (01=No. 1, 02=No. 2, 03=No. 3) generator DIFF light on. Generator field and breaker OPEN lights on, all bus tie breaker flowbars on. PMG volts OK. 2. 24-21-00 Fig. 112A Block 2
24 21 52 __	1. (01=No. 1, 02=No. 2, 03=No. 3) generator DIFF light on. Generator field, breaker, all bus tie breaker, and APU generator breaker OPEN light on. 2. 24-21-00 Fig. 112A Block 2
24 21 53 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	24 21 54 __	1. (01=Gen 1, 02=Gen 2, 03=Gen 3) tie breaker flowbar on intermittently, accompanied by intermit (instrument) flags on F/O panel voltage and frequency show slight fluctuation. 2. 24-21-00 Fig. 104 Block 10
	24 21 55 00	1. APU generator frequency abnormal, system operation normal.
R		2. 49-11-00 Fig. 130 Block 1
	24 21 56 00	1. APU generator (breaker, or breaker and field) OPEN light(s) on; DIFF light off. Generator reset; generator breaker OPEN light on, frequency abnormal. 2. 24-21-00 Fig. 112 Block 1
	24 31 01 00	1. DC essential bus FAIL light on. ESS DC volts and amps OK. 2. 24-31-00 Fig. 105 Block 22
	24 31 02 __	1. (06=Bus 1, 07=Bus 2, 08=Bus 3, 09=ESS Bus) DC bus isolation OPEN light on with switch latched out; all other indications normal. 2. 24-31-00 Fig. 106 (Sheet 1) Block 7
	24 31 03 __	1. (06=Bus 1, 07=Bus 2, 08=Bus 3, 09=Ess Bus) DC volts ok, T/R amps zero. DC bus isolation OPEN light off with switch latched out. 2. 24-31-00 Fig. 103 Block 9 (Bus 1) 24-31-00 Fig. 104 Block 9 (Bus 2) 24-31-00 Fig. 104 Block 9 (Bus 3) 24-31-00 Fig. 105 Block 12 (ESS Bus)

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 31 04 __	1. (06=Bus 1, 07=Bus 2, 08=Bus 3, 09=Ess Bus) DC volts ok, T/R amps zero. DC bus isolation OPEN light on with switch latched in. 2. 24-31-00 Fig. 107 Block 3
24 31 05 __	1. (06=Bus 1, 07=Bus 2, 08=Bus 3, 09=Ess Bus) DC volts zero; DC amps ok. DC bus isolation OPEN light off with switch latched out. 2. 24-31-00 Fig. 107 Block 7
24 31 06 __	1. (06=Bus 1, 07=Bus 2, 08=Bus 3, 09=ESS Bus) DC volts zero; DC amps OK. DC bus isolation OPEN light on with switch latched in. 2. 24-31-00 Fig. 103 Block 12 (Bus 1) 24-31-00 Fig. 107 Block 19 (Bus 2) 24-31-00 Fig. 107 Block 19 (Bus 3) 24-31-00 Fig. 107 Block 19 (ESS Bus)
24 31 07 00	1. Essential bus DC volts and amps zero. DC bus isolation OPEN light on with switch latched in. DC essential bus FAIL light off. 2. 24-31-00 Fig. 105 Block 16
24 31 08 00	1. Essential bus DC volts and amps zero. DC bus isolation OPEN light on with switch latched in. DC essential bus FAIL light on. 2. 24-31-00 Fig. 105 Block 11
24 31 09 __	1. (06=Bus 1, 07=Bus 2, 08=Bus 3) DC volts and amps zero. DC bus isolation OPEN light on with switch latched in. 2. 24-31-00 Fig. 103 Block 8 (Bus 1) 24-31-00 Fig. 104 Block 8 (Bus 2 or 3) 24-31-00 Fig. 105 Block 11 (ESS Bus)

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 31 10 __	1. (06=Bus 1, 07=Bus 2, 08=Bus 3, 09=Ess Bus) DC volts and amps zero. DC bus isolation OPEN light off with switch latched out.
	2. 24-31-00 Fig. 107 Block 12
24 32 01 00	1. STBY PWR ON light on with STANDBY POWER switch in ARM, BATTERY switch on. All other indications normal.
	2. 24-32-00 Fig. 105 (Sheet 1) Block 5
24 32 02 00	1. Battery DC volts OK, battery charger not charging, all other indications normal.
	2. 24-32-00 Fig. 103 (Sheet 3) Block 3
24 32 03 00	1. DC STBY volts zero, ESS/STBY POWER light on, all other indications normal.
	2. 24-32-00 Fig. 105 (Sheet 2) Block 20
24 32 04 00	1. Inverter volts 115V AC, STBY PWR ON light on with BATTERY switch ON, STANDBY POWER switch in ARM. All other indications normal.
	2. 24-32-00 Fig. 105 (Sheet 1) Block 12
24 32 05 00	1. Inverter volts 115V AC, STBY PWR flowbar on with BATTERY switch ON, STANDBY POWER switch in ARM, all other indications normal.
	2. 24-32-00 Fig. 105 (Sheet 1) Block 15
24 32 06 00	1. BATTERY DC volts high or low (<30 or >35 VDC), no battery charger pulse. All other indications normal.
	2. 24-32-00 Fig. 103 (Sheet 1) Block 7
24 32 07 00	1. NOT USED.
24 32 08 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 32 09 00	1. Continuous charge, no pulse mode; all other indications normal. 2. 24-32-00 Fig. 103 (Sheet 1) Block 7
24 32 10 00	1. DC STBY BUS FAIL light on. All other indications normal. 2. 24-32-00 Fig. 105 (Sheet 1) Block 8
24 32 11 00	1. AC STBY BUS FAIL light on, all other indications normal. 2. 24-32-00 Fig. 105 (Sheet 1) Block 7
24 32 12 00	1. UNARM light on, BATTERY switch ON, STANDBY POWER switch in ARM. 2. 24-32-00 Fig. 104 Block 9
24 32 13 00	1. Standby power UNARM light not on with STANDBY POWER switch OFF, BATTERY switch ON. All other indications normal. 2. 24-32-00 Fig. 104 Block 8
24 32 14 00	1. STBY PWR flowbar not on with STANDBY POWER switch in ON, inverter volts zero. All other indications normal. 2. 24-32-00 Fig. 106 Block 7
24 32 15 00	1. Inverter volts zero, STBY PWR flowbar on, STANDBY POWER switch ON. 2. 24-32-00 Fig. 106 Block 12
24 32 16 00	1. Inverter volts 115V AC, STBY PWR flowbar off, STANDBY POWER switch ON. 2. 24-32-00 Fig. 106 Block 10

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 32 17 00	1. Standby power UNARM light not on with BATTERY switch OFF, STANDBY POWER switch in ARM, all other indications normal.
	2. 24-32-00 Fig. 104 Block 8
24 32 18 00	1. BATTERY CONDITION light on, BATTERY switch ON, STANDBY POWER switch in ARM, no battery charger pulse, all other indications normal.
R	2. 24-32-00 Fig. 103 (Sheet 3) Block 8
24 32 19 00	1. BATTERY CONDITION light on, BATTERY switch ON, STANDBY POWER switch in ARM position,no battery charger pulse, AVIONIC AIR MID OVBD light on; all other indications normal.
	2. 24-32-00 Fig. 103 (Sheet 3) Block 7
24 41 01 00	1. EXT PWR AVAIL light off with external power cart connected.
	2. 24-41-00 Fig. 103 Block 8
24 41 02 00	1. EXT PWR ON light off with external power on.
	2. 24-41-00 Fig. 103 Block 14
24 41 03 00	1. AC bus 1 tie breaker would not close with APU power in ground service mode.
	2. 24-41-00 Fig. 105 Block 9
24 41 04 00	1. APU generator field and breaker open with APU power in ground service mode.
	2. 24-41-00 Fig. 105 Block 5
24 41 05 00	1. AC bus 2 and 3 tie breakers closed with external power in ground service mode.
	2. 24-41-00 Fig. 104 Block 10

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 41 06 00	1. FE/SO GND SERVICE switch stays in EXT PWR position with attendants GND SVCE ON switch on; EXT PWR switch OFF.
	2. 24-41-00 Fig. 104 Block 16
24 41 07 00	1. FE/SO GND SERVICE switch will not hold in EXT PWR position; EXT PWR ON light off, AVAIL light on.
	2. 24-41-00 Fig. 104 Block 9
24 41 08 00	1. EXT PWR AVAIL light off with external power cart connected and GND SERVICE switch in EXT PWR position.
	2. 24-41-00 Fig. 103 Block 8
24 51 01 00	1. Both hydraulic AC PUMPS (B3, C3) ON lights off, switches in; would not reset. All other indications normal.
	2. 24-51-00 Fig. 104 (Sheet 2) Block 16
24 51 02 00	1. One Hydraulic AC PUMPS (B3, C3) ON light off, switches in. All other indications normal.
	2. 24-51-00 Fig. 104 (Sheet 2) Block 16
24 51 03 __	1. (13=Galy Pwr Bus 1, 14=Galy Pwr Bus 2, 15=Galy Pwr Bus 3) GALLEY POWER OFF light on, switches in.
	2. 24-51-00 Fig. 104 (Sheet 2) Block 5
24 51 04 00	1. All GALLEY POWER OFF lights on, switches in; reset OK. Both AC PUMPS (B3, C3) ON lights off, switches in; would not reset.
	2. 24-51-00 Fig. 104 (Sheet 2) Block 16
24 51 05 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 51 06 00	1. All GALLEY POWER OFF lights on, switches in; reset OK. One AC PUMPS (B3, C3) ON light off, switches in.
	2. 24-51-00 Fig. 104 (Sheet 1) Block 16
24 51 07 00	1. All GALLEY POWER OFF lights on, switches in; would not reset. Load normal.
	2. 24-51-00 Fig. 104 (Sheet 1) Block 4
24 51 08 00	1. All GALLEY POWER OFF lights on, switches in; would not reset. Load high.
	2. 24-51-00 Fig. 104 (Sheet 1) Block 9
24 51 09 __	1. (13=Galy Pwr Bus 1, 14=Galy Pwr Bus 2, 15=Galy Pwr Bus 3) GALLEY POWER bus OFF lights off, all switches out.
	2. 24-51-00 Fig. 104 (Sheet 2) Block 9
24 51 10 __	1. (10=AC Bus 1, 11=AC Bus 2, 12=AC Bus 3) FLT STA BUS FAIL light on, ELECTRICAL SYSTEM light on.
	2. 24-51-00 Fig. 103 Block 1
24 53 01 00	1. CB3-E12 circuit breaker tripped, AC essential bus switch set to AUTO B3 (G1). AC ESS BUS FAIL and ESS AC ON ALT lights off.
	2. 24-53-00 Fig. 103 Block 12
24 53 02 00	1. CB3-E13 circuit breaker tripped, AC essential bus switch set to AUTO B3 (G2). AC ESS BUS FAIL and ESS AC ON ALT lights off.
	2. 24-53-00 Fig. 104 Block 12

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 53 03 00	1. CB3-E13 circuit breaker tripped, AC essential bus switch set to AUTO G1(G2). AC ESS BUS FAIL and ESS AC ON ALT lights off. 2. 24-53-00 Fig. 105 Block 3
24 53 04 00	1. ESS AC ON ALT Light on, AC essential bus switch set to AUTO B3(G1). AC ESS BUS FAIL and FLT STA BUS FAIL No. 3 lights off. ELECTRICAL SYSTEM light on. 2. 24-53-00 Fig. 103 Block 18
24 53 05 00	1. ESS AC ON ALT Light on, AC essential bus switch set to AUTO B3(G2). AC ESS BUS FAIL and FLT STA BUS FAIL No. 3 lights off. ELECTRICAL SYSTEM light on. 2. 24-53-00 Fig. 104 Block 18
24 53 06 00	1. ESS AC ON ALT light on. AC essential bus switch set to AUTO G1 (G2). GEN 1 AC volts OK. 2. 24-53-00 Fig. 105 Block 19
24 53 07 00	1. AC ESS BUS FAIL light on. FLT STA BUS FAIL No. 3 light off. GEN 1 AC volts OK, AC essential bus selector switch set to AUTO B3(G1). 2. 24-53-00 Fig. 103 Block 7
24 53 08 00	1. AC ESS BUS FAIL light on. FLT STA BUS FAIL No. 3 light off. GEN 1 AC volts not OK. 2. 24-53-00 Fig. 103 Block 7
24 33 09 00	1. AC ESS bus FAIL light on. FLT STA BUS FAIL No. 3 light off, GEN 2 AC volts OK. 2. 24-53-00 Fig. 104 Block 7

FAULT CODE INDEX
TABLE 1

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
24 53 10 00	1. AC ESS bus FAIL light on. FLT STA BUS FAIL No. 3 light off, Gen 2 AC volts not OK.
	2. 24-53-00 Fig. 104 Block 7
24 53 11 00	1. AC ESS BUS FAIL Light on, AC essential bus switch set to AUTO G1(G2). GEN 1 AC volts OK.
	2. 24-53-00 Fig. 105 Block 7
24 53 12 00	1. AC ESS BUS FAIL Light on, AC essential bus switch set to AUTO G1(G2). GEN 1 AC volts not OK, GEN 2 AC volts OK.
	2. 24-53-00 Fig. 105 Block 9
24 53 13 00	1. ESS AC ON ALT light on. AC essential bus switch set to AUTO G1 (G2). GEN 1 AC volts not OK (give actual reading).
	2. 24-53-00 Fig. 105 Block 9

ELECTRICAL POWER - DESCRIPTION AND OPERATION

1. General

The electrical power system (Ref. Fig. 1 and 2, and Table 1) generates and distributes three-phase ac power and dc power to operate the electrical and electronic systems. The system consists of a primary 117/208V, 400 Hz generating system, an ac distribution system, a standby static inverter, a 28V (nominal) dc conversion system, a dc distribution system, and a 26V nickel-cadmium battery. The battery and inverter provide emergency standby power to operate essential systems when power is not available from normal sources. The battery also provides power to start the APU.

The total electrical system capacity is sufficient so that the aircraft can be dispatched with one failed ac source and one failed dc source. The electrical system operates automatically, with visual monitoring and manual generator and bus control available to the Flight Engineer/Second Officer.

Alternating current distribution is through a four-wire system using the aircraft structure as the fourth wire (ground). Direct current distribution is through a two-wire system using the aircraft structure as the second wire (ground).

General Characteristics of Electrical System
Table 1

ITEM	CHARACTERISTIC
AC SYSTEM CHARACTERISTICS	
Power requirements	115/200V, 400 Hz, three-phase. Normal ac load requirements approximately 150 kVA (cruise condition)
AC generator (4) Lear Siegler (No. 1, 2, and 3 engines and APU)	90 kVA each, continuous output, three-phase, engine-driven, Y-connected, self-excited, brushless and oil-cooled. Normally paralleled through bus tie breakers.

General Characteristics of Electrical System (Cont)
Table 1

ITEM	CHARACTERISTIC
AC bus 1 (mid electrical service center)	115/200V (nominal), 400 Hz, three-phase. Normally energized from No. 1 generator through No. 1 generator breaker (secondary source - tie bus)
AC bus 1 extension (flight station)	115/200V (nominal), 400 Hz, three-phase. Energized directly from ac bus 1
Galley ac bus 1 (galley left circuit breaker panel)	115/200V (nominal), 400 Hz, three-phase. Energized directly from ac bus 1
Forward ac ground service bus (flight station)	115v (nominal), 400 HZ, single-phase. Energized directly from ac bus 1
Passenger service buses 1L and 1R (galley left and right circuit breaker parels)	115/200V (nominal), 400 Hz, three-phase. Energized from ac bus 1
AC bus 2 (mid electrical service center)	115/200v (nominal), 400 Hz, three-phase. Energized from No. 2 generator through No. 2 generator breaker (secondary source - tie bus)
AC bus 2 extension (flight station)	115/200V (nominal), 400 Hz, three-phase. Energized directly from ac bus 2
No. 2 ac radio bus (flight station)	115/200V (nominal), 400 Hz, three-phase. Energized from ac bus 2 extension through No. 2 ac master radio relay
Galley ac bus 2 (galley left circuit breaker panel)	115/200V (nominal), 400 Hz, three-phase. Energized directly from ac bus 2
Passenger service buses 2L and 2R (galley left and right circuit breaker panels)	115/200V (nominal), 400 Hz, three-phase. Energized from ac bus 2

General Characteristics of Electrical System (Cont)
Table 1

ITEM	CHARACTERISTIC
Galley ac bus 3 (galley left circuit breaker panel)	115/200V (nominal), 400 Hz, three-phase. Energized directly from ac bus 3
Passenger service buses 3L and 3R (galley left and right circuit breaker panels)	115/200V (nominal), 400 Hz, three-phase. Energized from ac bus 3
AC essential bus (flight station)	115/200v (nominal), 400 Hz, three-phase. Normally energized from ac bus 3 through ac essential relay No. 3, but can be transferred to generator No. 1 or 2 through ac essential relay No. 1 or 2
Essential ac radio bus (flight station)	115/200V (nominal), 400 Hz, three-phase. Energized from ac essential bus through essential ac master radio relay
AC standby bus (flight station)	115V (nominal), 400 Hz, single-phase. Normally energized from Phase A of ac essential bus through ac standby transfer relay. Energized from inverter if ac essential bus becomes deenergized
R Inverter, static, 115V ac, R 400 Hz (Mid electrical service center)	750 voltampere, single-phase, solid state. Energized from standby battery
115/26V stepdown transformers, three units (forward electronic service center)	One each energized from ac standby bus, ac essential bus, and ac bus 2 extension.
Voltage limits of ac system	107.5 to 122 (steady-state operation)
Frequency limits	396 to 404 Hz (steady-state operation)
Phase rotation of ac system	ABC

General Characteristics of Electrical System (Cont)
Table 1

ITEM	CHARACTERISTIC
DC SYSTEM CHARACTERISTICS	
Transformer-rectifier (TR) (4) (forward electronic service center)	Input 115/200V, 400 Hz, three-phase, solid state, convection cooled. Output 28 V (nominal) at 75 amps, non-regulated - normal power source for all dc buses except battery bus and battery bus extension. TR outputs normally paralleled through dc bus tie breakers.
Battery, 26V nickel-cadmium (mid electrical service center)	Power source for battery bus, battery bus extension, and APU battery bus. Emergency source for dc standby bus and essential communications bus
Charger, battery, solid state (mid electrical service center)	Input: 115/200V, 400 Hz, three-phase, from ac bus 1. Output: 30 to 34 volts dc (nominal) at 40 amperes (nominal). Maintains battery in fully charged condition
DC bus 1 (flight station)	Energized from TR No. 1 through dc ground service relay (secondary source - dc tie bus through dc tie breaker No. 1)
DC ground service bus (flight station)	Energized directly from TR No. 1
DC ground service bus extension (galley)	Energized directly from TR No. 1 (secondary source - tie bus)
APU battery bus (aft electronic equipment area)	Normally energized from standby battery through APU power transfer relay (energized from dc ground service bus when APU is operating).
DC bus 2 (flight station)	Energized from No. 2 TR (secondary source - DC tie bus)

General Characteristics of Electrical System (Cont)
Table 1

ITEM	CHARACTERISTIC
No. 2 dc radio bus (flight station)	Energized from dc bus 2 through No. 2 dc master radio relay
DC bus 3 (flight station)	Energized from No. 3 TR (secondary source - DC tie bus)
Galley dc bus (galley)	Energized from dc bus 3
DC Essential bus (flight station)	Energized directly from essential TR (secondary source-dc tie bus)
DC Essential radio bus (flight station)	Energized from dc essential bus through essential dc master radio relay
DC Standby bus (flight station)	Energized from dc essential bus through dc standby transfer relay (secondary source - battery bus through dc standby transfer relay)
Battery bus (flight station and mid electrical service center)	Energized directly from battery
Engine start bus	Energized from dc essential bus (secondary source - battery bus)
Essential communications bus (flight station)	Energized from dc essential bus (secondary source - battery bus)
DC voltage limits (steady state operation)	24 to 28.5 volts
Normal current drain (cruise conditions)	160 amperes (approximately)

One integrated drive generator (IDG) is mounted on each engine external gearbox (Ref. Fig. 3). The APU-driven generator is mounted on the APU in the aft fuselage. A three-phase polarized external power receptacle is installed in a recessed area under a hinged door on the lower right fuselage at FS 458. The majority of the control components are located in the mid electrical service center, just forward of the main beam and aft of the galley.

The principal distribution centers are the mid electrical service center, zone 137; the forward electronic service center, zone 112 and 113, the flight station, zones 210, 211, 212 and 215; the aft galley wall, zone 130; and the aft electronic equipment area, zone 164.

Eleven circuit breaker panel sections are installed in the flight station (Ref. Fig. 3): five overhead and six on the flight station aft bulkhead. The 11 sections are combined to form three panels for nomenclature purposes.

The three sections immediately aft of the pilots overhead control panels are the pilots overhead circuit breaker panel CB1. The two sections above the Flight Engineer/Second Officers seat are the Flight Engineer/Second Officers overhead circuit breaker panel CB2. The six sections on the aft bulkhead are the Flight Engineer/Second Officers aft circuit breaker panel CB3.

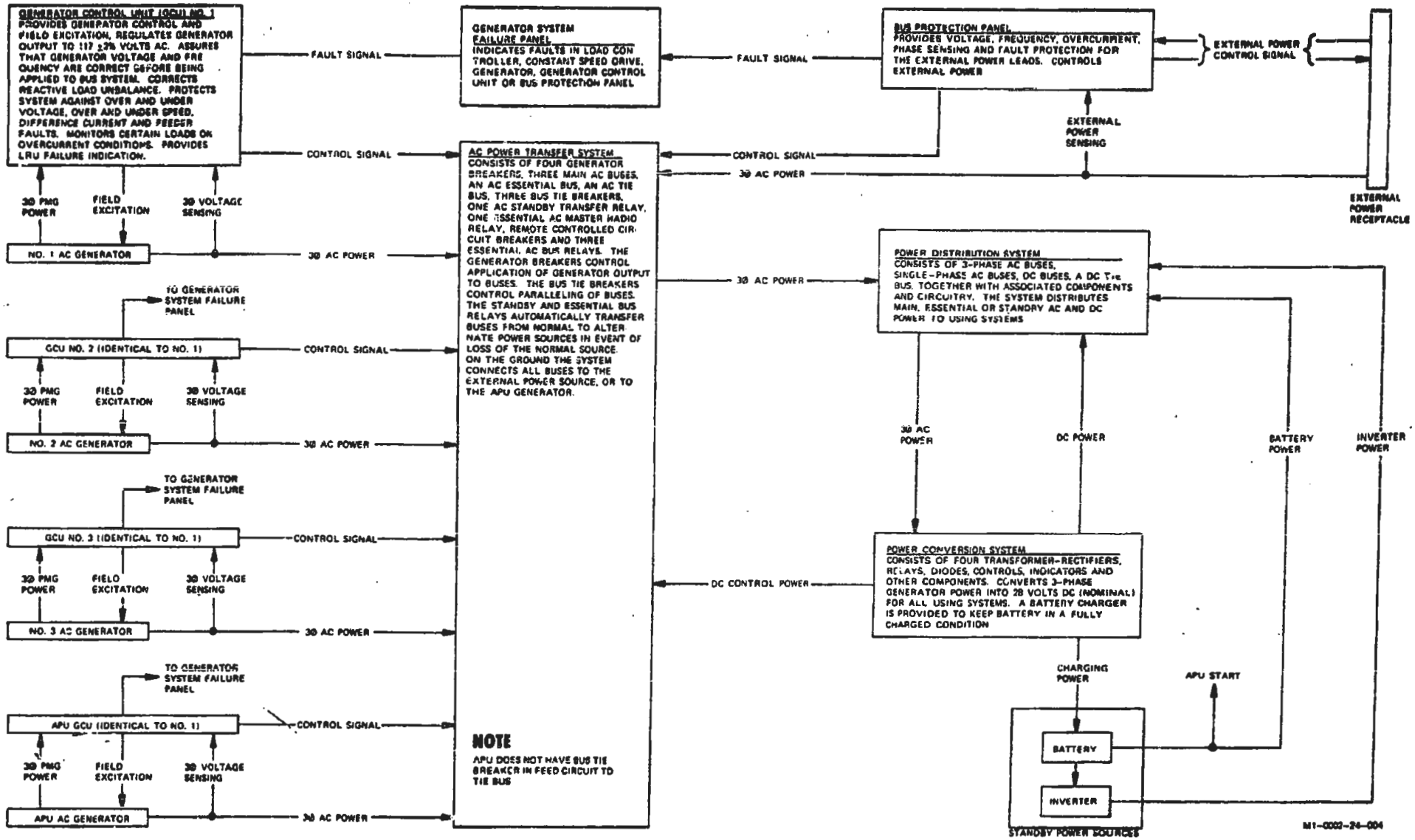
Two circuit breaker panels are installed in the aft bulkhead of the galley (Ref. Fig. 3): one on each side of the galley lifts. The panels which are identified as the galley left and galley right circuit breaker panels, contain circuit breakers for passenger service and ground operation functions.

Various secondary circuit breaker panels are covered under the specific system. These panels are fed from the main circuit breaker panels and are not part of the main electrical system. For circuit breaker panel details, refer to 24-50-00.

2. Operation

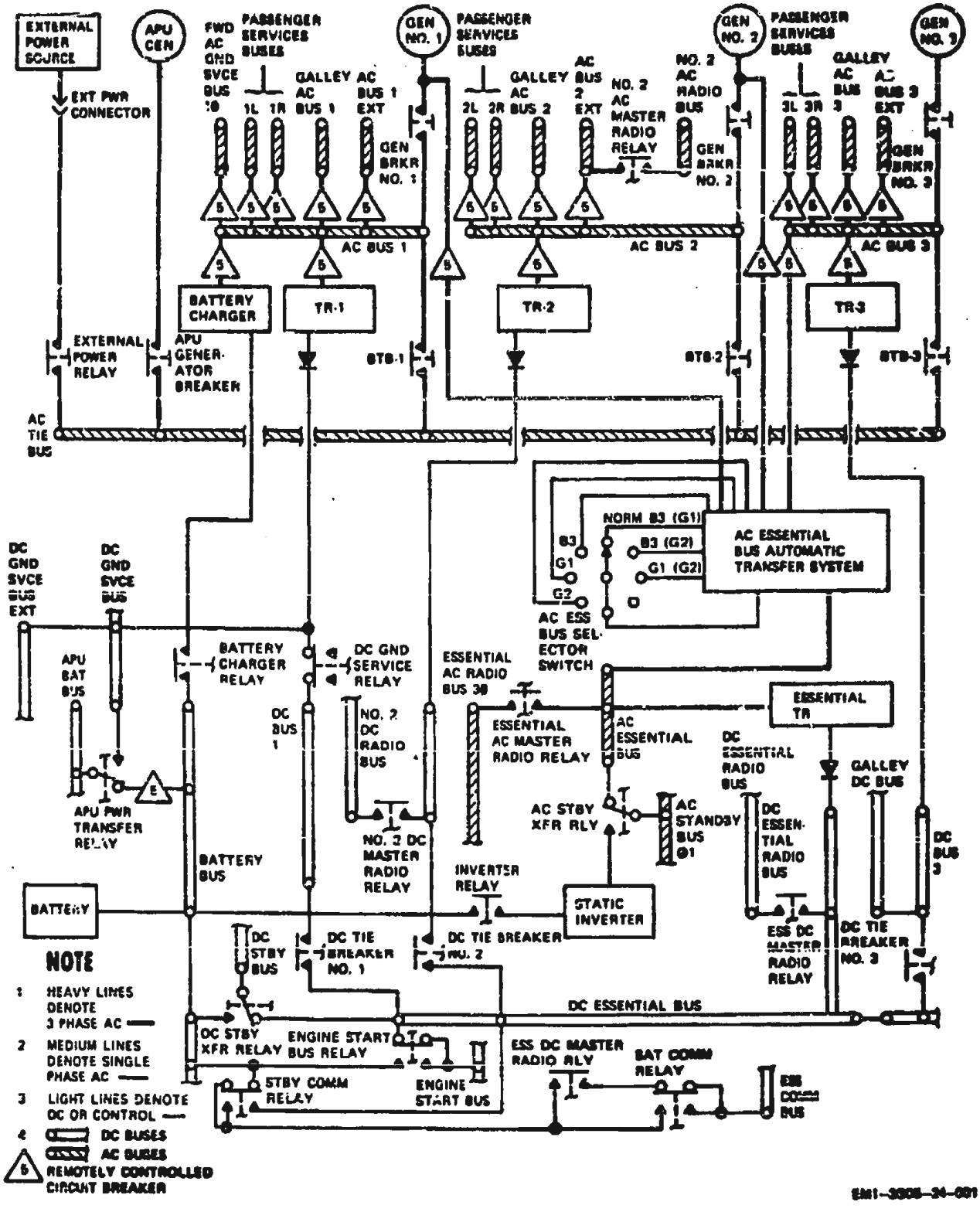
A. External Power

For ground operation, an external power source is connected to the external power receptacle. An external power source, which uses the dc voltage on pin F of the external power receptacle to control the output, must be used to obtain the additional external power feeder protection provided by the aircraft system. When the EXT PWR switch on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, (Ref. Fig. 4) is placed in the ON position, the bus protection panel (BPP) circuits close the external power relay, which connects external power to the tie bus. Bus tie breakers (BTB) 1, 2, and 3, which are normally closed when the generators are not operating, connect tie bus power to ac buses 1, 2, and 3 (Ref. Fig. 2). The essential ac bus is energized from its normal source (ac bus 3), and the dc conversion system supplies power to the dc buses. Lights on the electrical control panel and at the external power receptacle indicate external power system status.

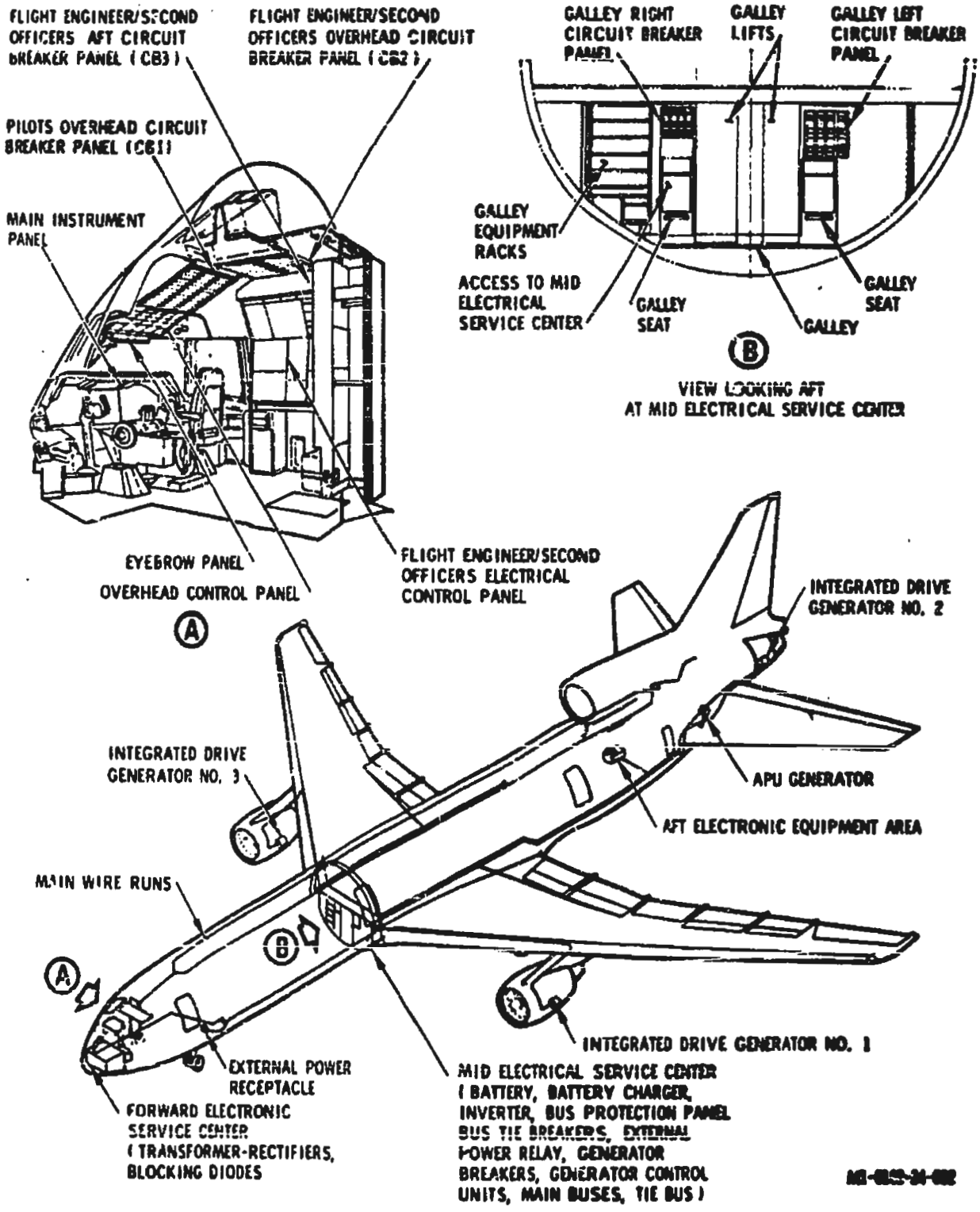

GENERATOR CONTROL UNIT (GCU) NO. 1
PROVIDES GENERATOR CONTROL AND FIELD EXCITATION, REGULATES GENERATOR OUTPUT TO 117 ±2% VOLTS AC. ASSURES THAT GENERATOR VOLTAGE AND FREQUENCY ARE CORRECT BEFORE BEING APPLIED TO BUS SYSTEM. CORRECTS REACTIVE LOAD UNBALANCE. PROTECTS SYSTEM AGAINST OVER AND UNDER VOLTAGE, OVER AND UNDER SPEED, DIFFERENCE CURRENT AND FEEDER FAULTS. MONITORS CERTAIN LOADS ON OVERCURRENT CONDITIONS. PROVIDES LRU FAILURE INDICATION.
FAULT SIGNAL
GENERATOR SYSTEM FAILURE PANEL
INDICATES FAULTS IN LOAD CONTROLLER, CONSTANT SPEED DRIVE, GENERATOR, GENERATOR CONTROL UNIT OR BUS PROTECTION PANEL
FAULT SIGNAL
BUS PROTECTION PANEL
PROVIDES VOLTAGE, FREQUENCY, OVERCURRENT, PHASE SENSING AND FAULT PROTECTION FOR THE EXTERNAL POWER LEADS. CONTROLS EXTERNAL POWER
EXTERNAL POWER CONTROL SIGNAL
EXTERNAL POWER SENSING
EXTERNAL POWER RECEPTACLE
CONTROL SIGNAL
AC POWER TRANSFER SYSTEM
CONSISTS OF FOUR GENERATOR BREAKERS, THREE MAIN AC BUSES, AN AC ESSENTIAL BUS, AN AC TIE BUS, THREE BUS TIE BREAKERS, ONE AC STANDBY TRANSFER RELAY, ONE ESSENTIAL AC MASTER RADIO RELAY, REMOTE CONTROLLED CIRCUIT BREAKERS AND THREE ESSENTIAL AC BUS RELAYS. THE GENERATOR BREAKERS CONTROL APPLICATION OF GENERATOR OUTPUT TO BUSES. THE BUS TIE BREAKERS CONTROL PARALLELING OF BUSES. THE STANDBY AND ESSENTIAL BUS RELAYS AUTOMATICALLY TRANSFER BUSES FROM NORMAL TO ALTERNATE POWER SOURCES IN EVENT OF LOSS OF THE NORMAL SOURCE. ON THE GROUND THE SYSTEM CONNECTS ALL BUSES TO THE EXTERNAL POWER SOURCE, OR TO THE APU GENERATOR.
3Ø AC POWER
3Ø PMG POWER
FIELD EXCITATION
3Ø VOLTAGE SENSING
NO. 1 AC GENERATOR
3Ø AC POWER
TO GENERATOR SYSTEM FAILURE PANEL
GCU NO. 2 (IDENTICAL TO NO. 1)
CONTROL SIGNAL
3Ø PMG POWER
FIELD EXCITATION
3Ø VOLTAGE SENSING
NO. 2 AC GENERATOR
3Ø AC POWER
TO GENERATOR SYSTEM FAILURE PANEL
GCU NO. 3 (IDENTICAL TO NO. 1)
CONTROL SIGNAL
3Ø PMG POWER
FIELD EXCITATION
3Ø VOLTAGE SENSING
NO. 3 AC GENERATOR
3Ø AC POWER
TO GENERATOR SYSTEM FAILURE PANEL
APU GCU (IDENTICAL TO NO. 1)
CONTROL SIGNAL
3Ø PMG POWER
FIELD EXCITATION
3Ø VOLTAGE SENSING
APU AC GENERATOR
3Ø AC POWER
NOTE
APU DOES NOT HAVE BUS TIE BREAKER IN FEED CIRCUIT TO TIE BUS
3Ø AC POWER
POWER DISTRIBUTION SYSTEM
CONSISTS OF 3-PHASE AC BUSES, SINGLE-PHASE AC BUSES, DC BUSES, A DC TIE BUS, TOGETHER WITH ASSOCIATED COMPONENTS AND CIRCUITRY. THE SYSTEM DISTRIBUTES MAIN, ESSENTIAL OR STANDBY AC AND DC POWER TO USING SYSTEMS
3Ø AC POWER
DC POWER
BATTERY POWER
INVERTER POWER
DC CONTROL POWER
POWER CONVERSION SYSTEM
CONSISTS OF FOUR TRANSFORMER-RECTIFIERS, RELAYS, DIODES, CONTROLS, INDICATORS AND OTHER COMPONENTS. CONVERTS 3-PHASE GENERATOR POWER INTO 28 VOLTS DC (NOMINAL) FOR ALL USING SYSTEMS. A BATTERY CHARGER IS PROVIDED TO KEEP BATTERY IN A FULLY CHARGED CONDITION
CHARGING POWER
APU START
BATTERY
INVERTER
STANDBY POWER SOURCES
M1-0002-24-004

R Electrical Power System Block Diagram
R Figure 1

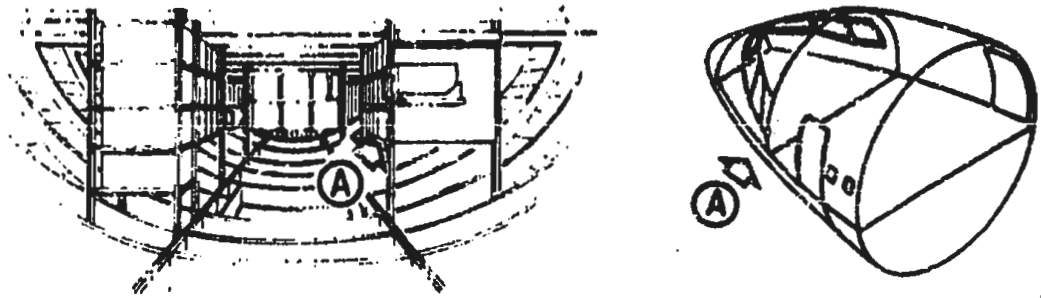
EFFECTIVITY: ALL



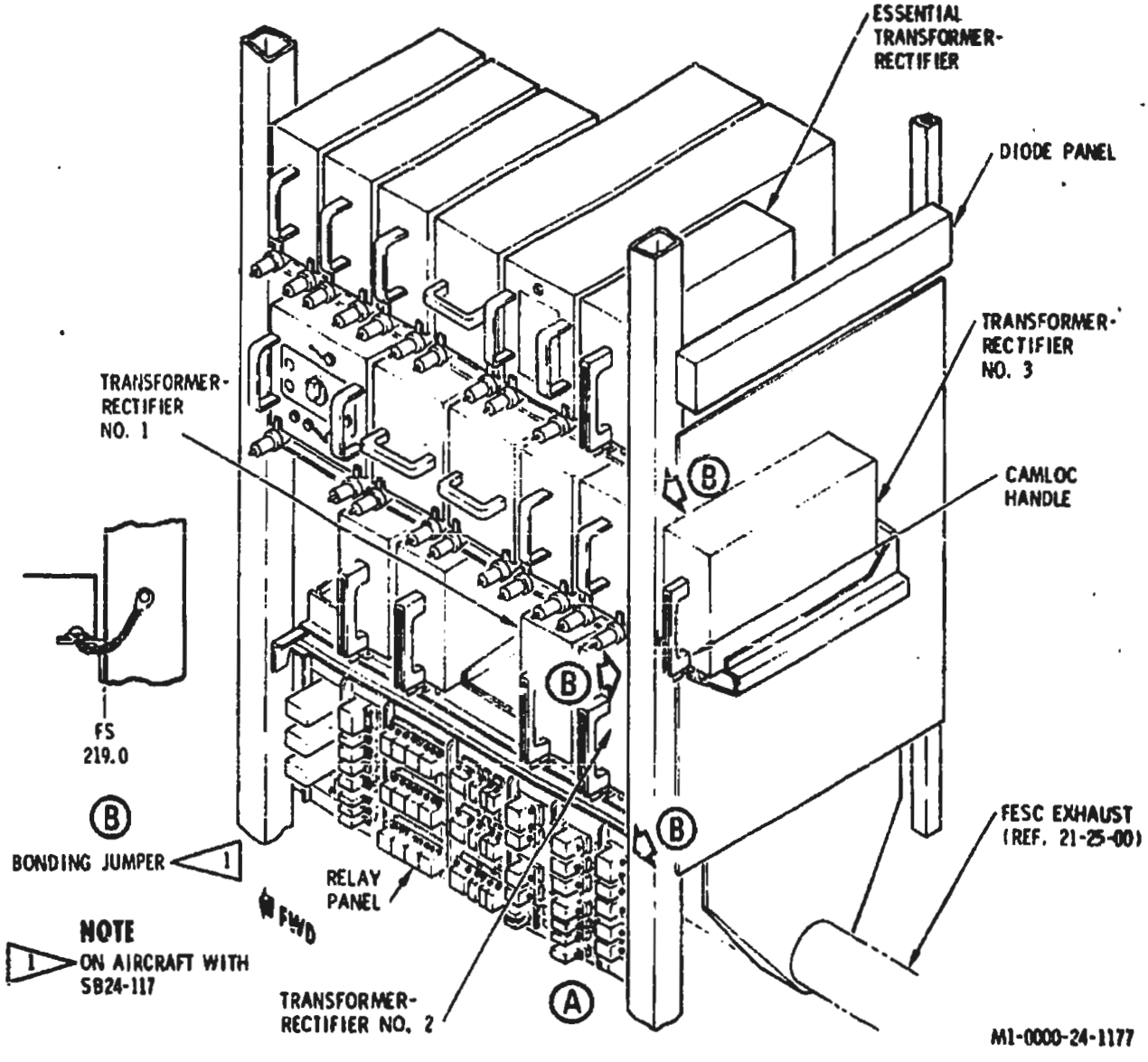
Electrical Power System Single Line Diagram
Figure 2


FLIGHT ENGINEER/SECOND OFFICERS AFT CIRCUIT BREAKER PANEL (CB3)
FLIGHT ENGINEER/SECOND OFFICERS OVERHEAD CIRCUIT BREAKER PANEL (CB2)
PILOTS OVERHEAD CIRCUIT BREAKER PANEL (CB1)
MAIN INSTRUMENT PANEL
EYEBROW PANEL
OVERHEAD CONTROL PANEL
FLIGHT ENGINEER/SECOND OFFICERS ELECTRICAL CONTROL PANEL
A
GALLEY RIGHT CIRCUIT BREAKER PANEL
GALLEY LIFTS
GALLEY LEFT CIRCUIT BREAKER PANEL
GALLEY EQUIPMENT RACKS
ACCESS TO MID ELECTRICAL SERVICE CENTER
GALLEY SEAT
GALLEY
GALLEY SEAT
B
VIEW LOOKING AFT AT MID ELECTRICAL SERVICE CENTER
INTEGRATED DRIVE GENERATOR NO. 2
INTEGRATED DRIVE GENERATOR NO. 3
APU GENERATOR
AFT ELECTRONIC EQUIPMENT AREA
MAIN WIRE RUNS
A
B
INTEGRATED DRIVE GENERATOR NO. 1
EXTERNAL POWER RECEPTACLE
FORWARD ELECTRONIC SERVICE CENTER (TRANSFORMER-RECTIFIERS, BLOCKING DIODES
MID ELECTRICAL SERVICE CENTER (BATTERY, BATTERY CHARGER, INVERTER, BUS PROTECTION PANEL BUS TIE BREAKERS, EXTERNAL POWER RELAY, GENERATOR BREAKERS, GENERATOR CONTROL UNITS, MAIN BUSES, TIE BUS)

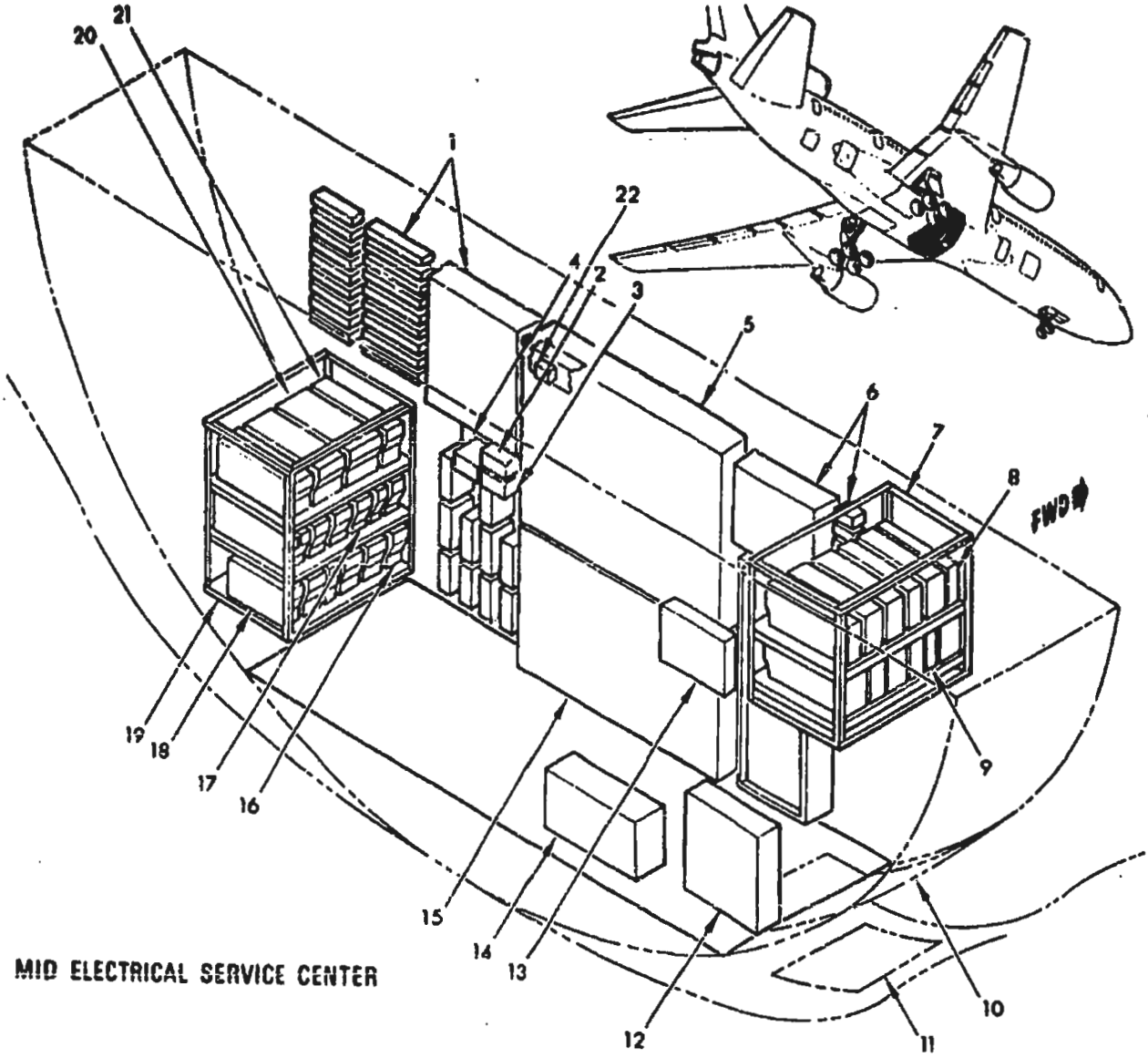
Electrical Power System Component Locations
Figure 3 (Sheet 1)



FORWARD ELECTRONIC SERVICE CENTER



R Electrical Power System Component Location
R Figure 3 (Sheet 2)



MID ELECTRICAL SERVICE CENTER

1 RELAY AND CIRCUIT BREAKER PANELS
2 LOAD CONTROLLER NO. 1
3 LOAD CONTROLLER NO. 2
4 LOAD CONTROLLER NO. 3
5 GENERATOR DISTRIBUTION PANEL
6 RELAY AND CIRCUIT BREAKER PANELS
7 RIGHT EQUIPMENT RACK
8 NO. 2 GENERATOR CONTROL UNIT
9 NO. 3 GENERATOR CONTROL UNIT
10 137AZ GROUND ACCESS DOOR
11 192N GROUND ACCESS DOOR
12 RELAY BOX, BATTERY POWER
13 GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL
14 BATTERY
15 REMOTE CIRCUIT BREAKER PANEL
16 APU GENERATOR CONTROL UNIT
17 NO. 1 GENERATOR CONTROL UNIT
18 BUS PROTECTION PANEL
19 LEFT EQUIPMENT RACK
20 INVERTER
21 BATTERY CHARGER
22 HYDRAULIC PUMP MAGNETIC CIRCUIT BREAKER PANEL

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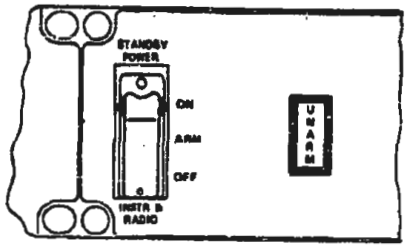
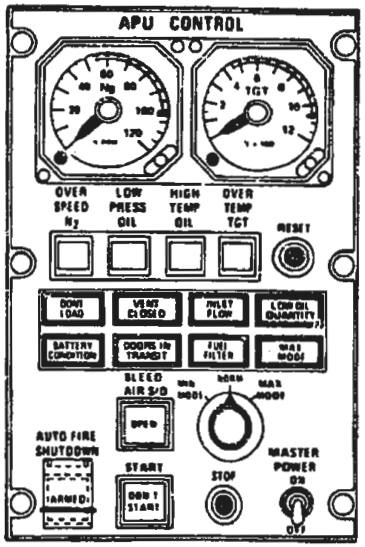
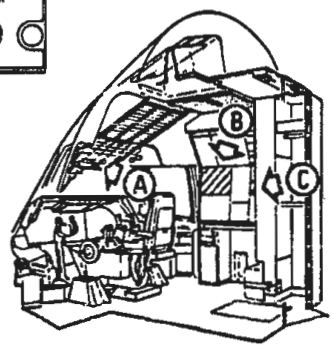
R Electrical Power System Component Locations
R Figure 3 (Sheet 3)

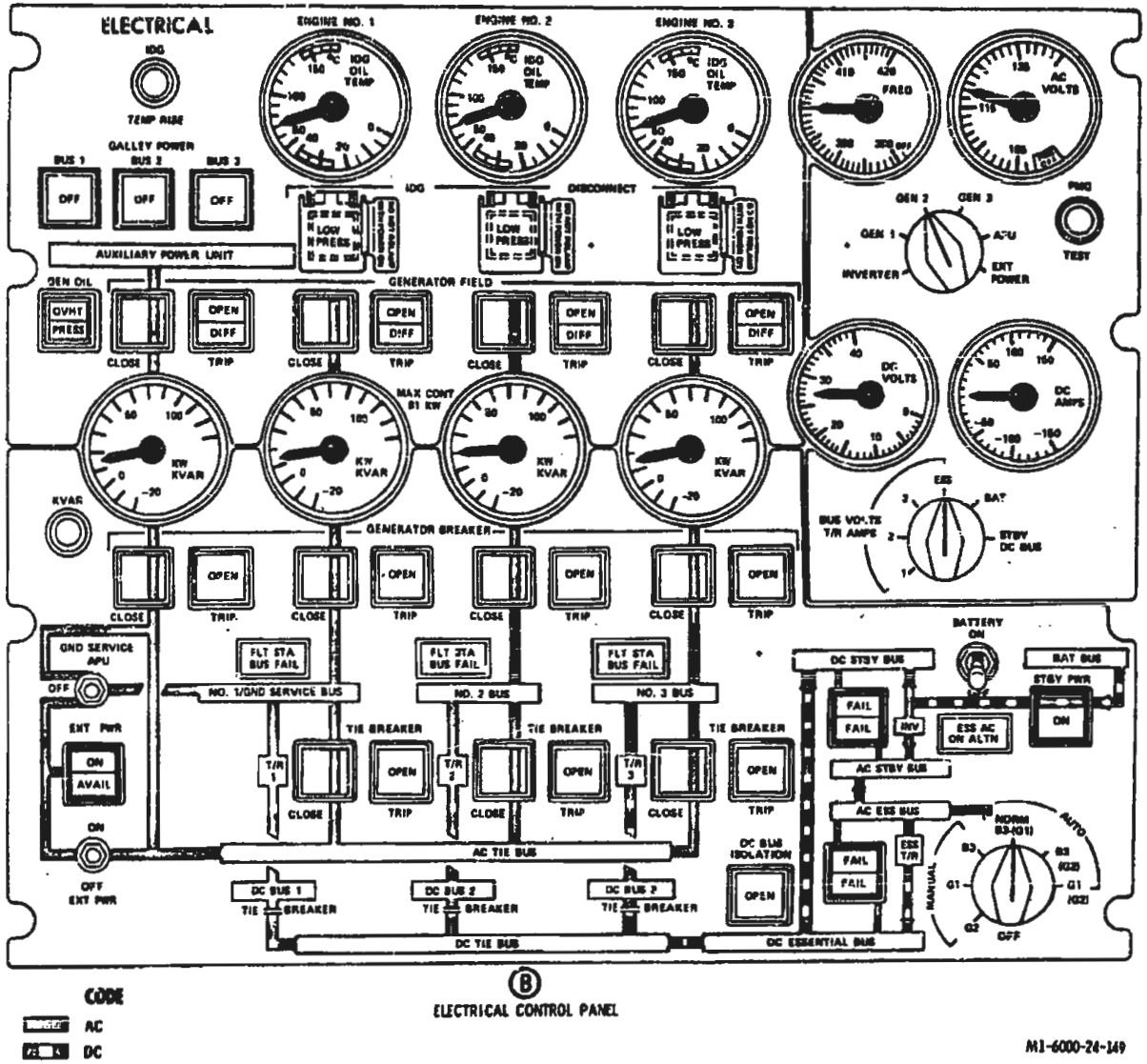


Ⓐ PILOTS EYEBROW PANEL



Ⓒ APU CONTROL PANEL





Ⓑ ELECTRICAL CONTROL PANEL

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Electrical Power System Controls and Indicators
Figure 4

When it is not desirable to energize the complete system, a ground service system is provided to supply selected loads from external power or from the APU generator. A GND SERVICE switch on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, or ON and OFF switchlights on the attendants forward control panel, zone 221, control system operation. When either switch is placed in the ON position, the circuit opens BTB-2 and BTB-3, which in turn deenergize ac buses 2 and 3 respectively. The same switch also energizes an auxiliary relay, which deenergizes certain ac bus 1 and dc bus loads not essential to ground service operations.

B. APU Generator

R The APU generator is used to energize the electrical system
R while on the ground, and also acts as a backup source below 25,000 feet in flight. When the engine-driven generators are not operating and the EXT PWR switch is in the OFF position, the APU generator energizes the ac bus system. With the APU operating and the external power relay deenergized, the APU generator breaker (GB) energizes. Energizing the APU generator breaker connects the APU generator output to the tie bus. The tie bus energizes all ac buses through associated BTB. Switchlights and indicators on the electrical control panel provide control and indication of generator operation.

C. Engine-driven Generator

When an engine-driven generator reaches operating frequency and voltage with external power on the bus system, a signal from the generator control unit trips the associated BTB and closes the associated GB. Tripping the associated BTB and closing the associated GB removes the corresponding bus brom external power and connects it to the generator. Tripping the BTB and closing the GB causes the generators to take over their individual loads, but they cannot parallel with each other or external power. When the EXT PWR switch is placed in the OFF position, the generators automatically parallel.

If the APU generator is energizing the system, each generator parallels with it as soon as conditions permit. Lights on the electrical control panel indicate system condition, and control switchlights permit manual control of generators and buses.

D. Standby Power System

The standby power system (Ref. 24-32-00) energizes selected essential loads for a minimum of 40 minutes whenever normal

power sources are not available. When the standby power system is operating normally, these loads are energized by the ac essential and dc essential buses. When the normal sources are not available, the essential dc loads are energized by the battery and the essential ac loads are energized by the inverter.

The system is controlled by a guarded control switch on the eyebrow panel, zone 210. Standby power system status is indicated by lights on the eyebrow panel and on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215.

3. Remote Control Circuit Breakers

A. Description

On aircraft with SB24-081, the LS10072B15 RCCB's for the fuel boost pumps are replaced with LS14394-20 RCCB's. For LS14394-( ) description, refer to Paragraph 3C.

R R The remote control circuit breaker (RCCB) is an electronic/electromechanical device which functions as a power contactor and circuit breaker. Four types of RCCB are used; LS10071-( ), LS10072B-( ), LS14393-( ) and LS14394-( ). The RCCB controls and protects components and equipment energized by 115V ac, 400 Hz, 3 phase; 115V ac, 400 Hz, single-phase; or 28V dc. The RCCB's are sealed units which have external power and control connections. The general electrical and mechanical characteristics of the RCCB's are listed in Table 2.

R R The four RCCB types operate in an identical manner and contain two basic operating devices (Ref. Fig. 5 for LS10071, LS10072B, and Fig. 12 for LS14393 and LS14394) These two devices are a solenoid-activated combination power contactor/circuit breaker, and an electronic logic module. The logic module is packaged within the RCCB housing. The RCCB's are located in an insulated box in the mid electrical service center, zone 137, and in the aft electronic equipment area, zone 164.

Remote Control Circuit Breaker Characteristics
Table 2

CHARACTERISTICS	
MINIMUM ULTIMATE TRIP	
115-percent Load	No trip at 25°C

Remote Control Circuit Breaker Characteristics (Cont)
Table 2

CHARACTERISTICS	
MAXIMUM ULTIMATE TRIP	
138-percent Load	1 hour maximum at 25°C
LOAD TYPES	
Lamp	28 V dc
Resistive	28 V dc
Inductive	28 V dc
Motor	28 V dc
Lamp	400 Hz, 115 V ac
Resistive	400 Hz, 115 V ac
Inductive	400 Hz, 115 V ac
Motor	400 Hz, 115 V ac
RUPTURE	
400 Hz, 120 V ac	2800 Amps
28 V dc	2800 Amps
DIMENSIONS	
DC or Single Phase AC	
Length	4.750 in. max.
Width	3.375 in. max.
Thickness	1.350 in. max.
Three Phase AC	
Length	4.750 in. max.
Width	3.375 in. max.
Thickness	3.850 in. max.

Remote Control Circuit Breaker Characteristics (Cont)
Table 2

CHARACTERISTICS	
MAXIMUM ALTITUDE	
AC or DC RCCB	50,000 feet
MAXIMUM OPERATING CYCLES	
AC or DC RCCB	50,000 cycles
MAXIMUM AMBIENT TEMPERATURE	
AC or DC RCCB	165°F
RATED LIFE AT RATED LOAD	
AC or DC RCCB	50,000 cycles

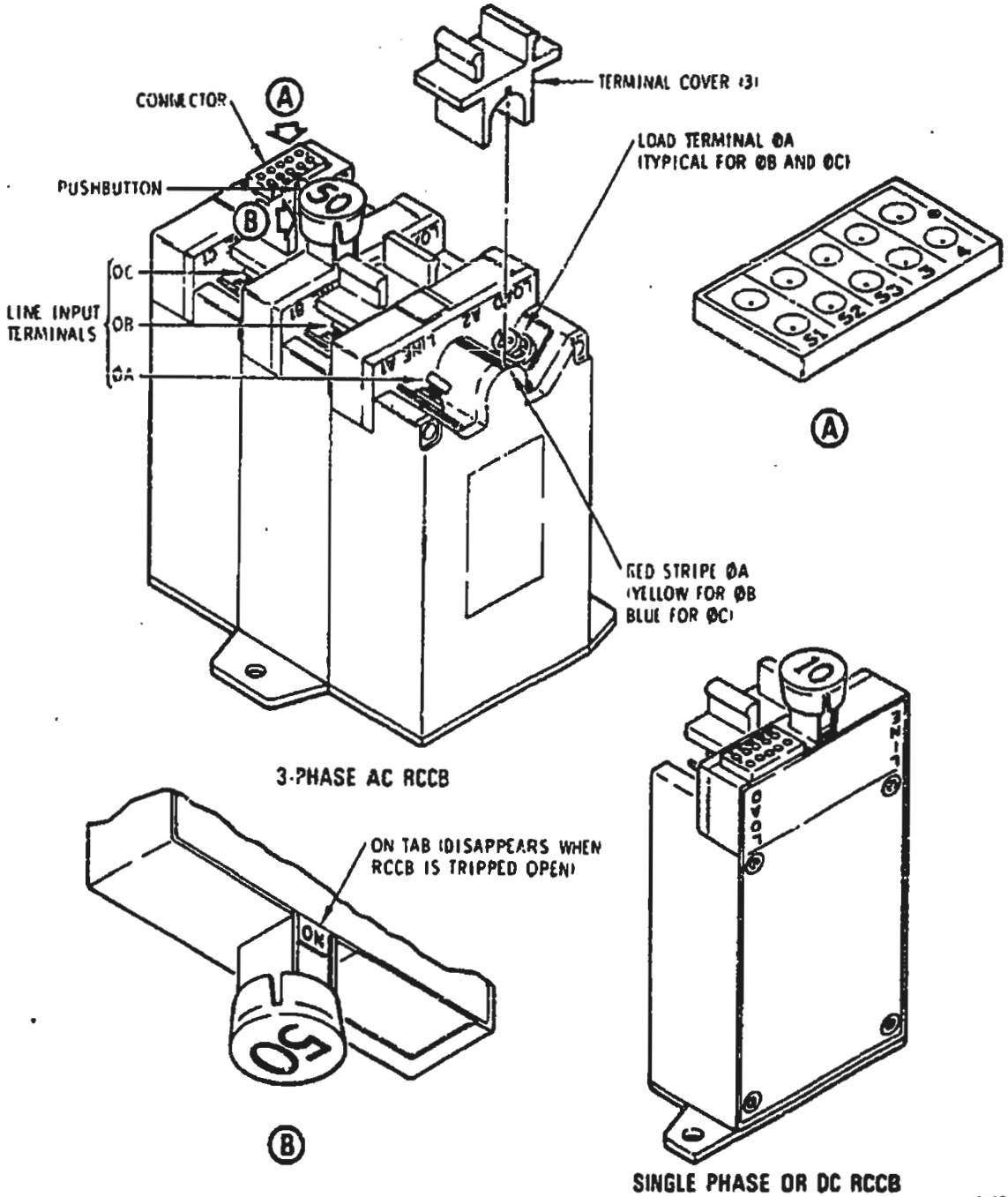
R R An RCCB system (Ref. Fig. 6 for LS10071, LS10072B, and Fig. 13 for LS14394) consists of the RCCB and a remote trip/set circuit breaker on the flight station or galley circuit breaker panels, zone 210 or 130 respectively. The trip/set circuit breaker is used as a trip and reset device to control operation of the RCCB and to provide remote indication of an overload (tripped) condition. Auxiliary contacts within the RCCB permit connection of switchlight lamps, or other indicating devices, to monitor RCCB operation.

The RCCB is a solenoid-activated device using silicon controlled rectifiers (SCR) to control solenoid circuits and limit switches to deenergize solenoid circuits. The RCCB is tripped and reset from the flight station (or galley) circuit breaker panels by using the trip/set circuit breaker or it can be manually tripped at the RCCB by using the manual pushbutton.

R R B. LS 10071-( ), LS10072B-( ) Remote Control Circuit Breaker Operation

(1) General

Operation of ac and dc RCCB's are similar. The four basic operating modes (Ref. Fig. 7) are the reset, trip, manual pushbutton, and overload. The heavy line in Figure 7 illustrates the overload protection path and represents the primary purpose of the RCCB. The thermal switch linkage senses a current overload on the



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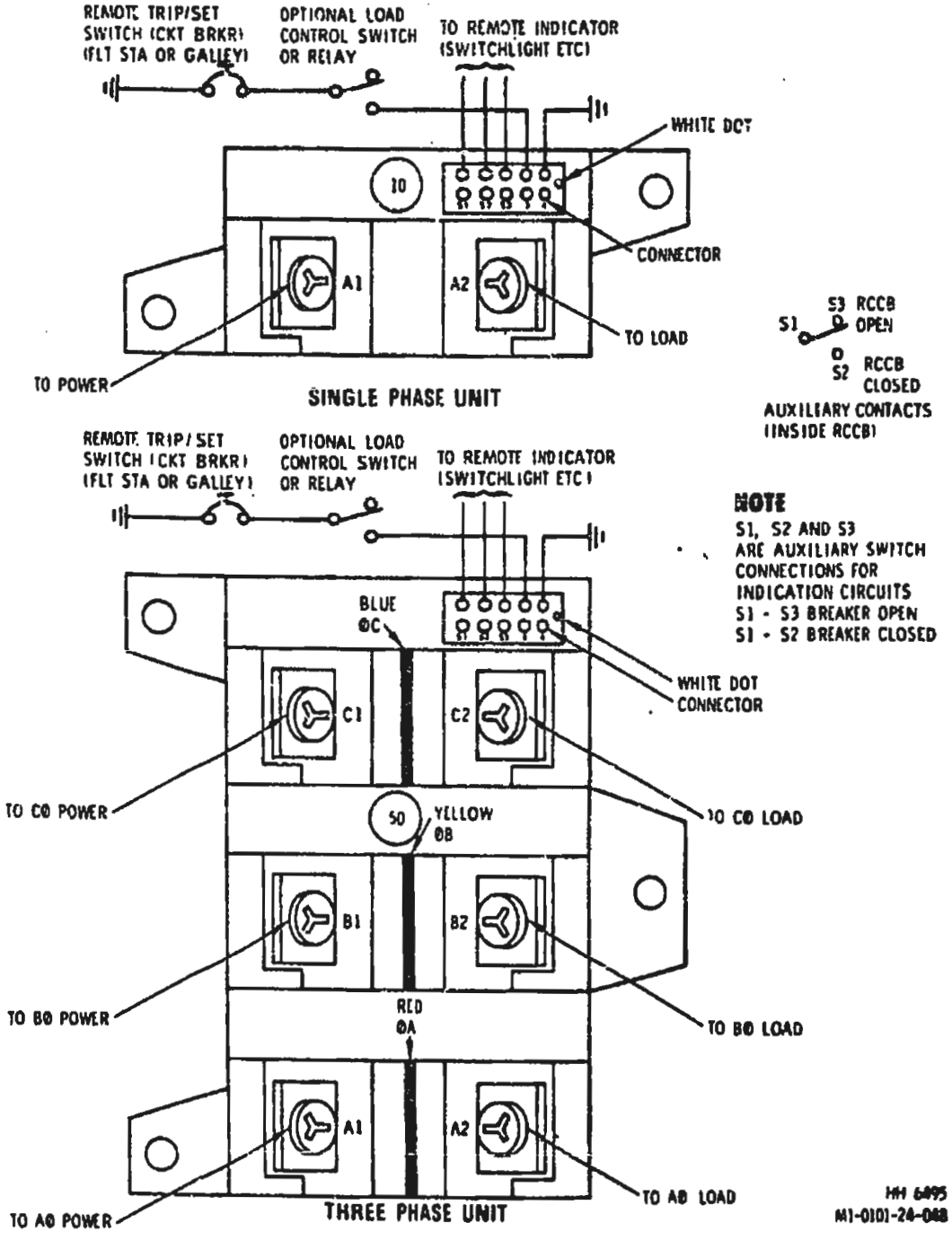
R LS10071( ) and LS10072( ) Remote Control Circuit Breaker
R Configurations
R Figure 5



R R LS10071( ) and LS10072( ) RCCB Control and Load Connections
Figure 6

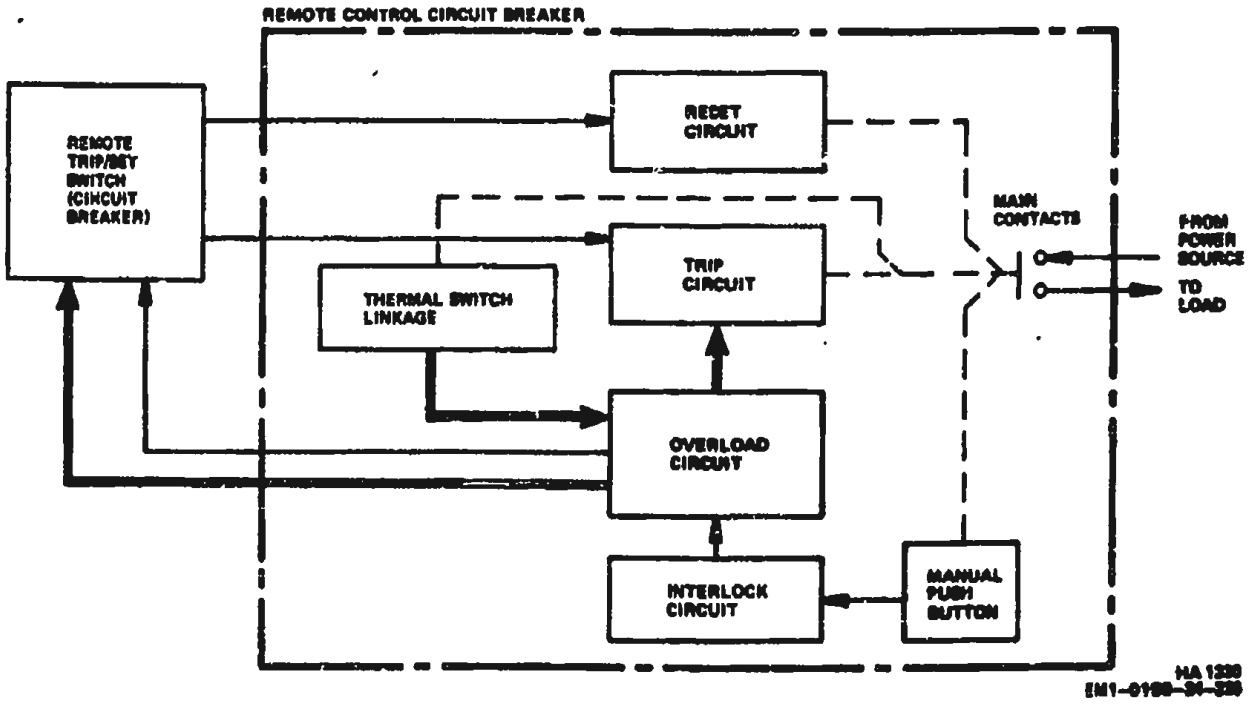
power line and triggers the overload circuit. The overload circuit energizes the trip circuit and also sends a controlled currentoverload to open the flight station (or galley) remote circuit breaker contacts. The following paragraphs provide a detailed description of the four operating modes.

NOTE: If any RCCB fails to close when the control circuit breaker and/or remote trip/reset circuit breaker is closed, reopen either switch and reclose.

(2) Reset Circuit Operation

Whenever the RCCB is tripped (Ref. Fig. 8) the main contacts are open, the trip/set circuit breaker is open, and the RCCB is ready to be reset. The ON tab, located on the RCCB pushbutton shaft, appears when the RCCB is closed, and disappers when the RCCB is tripped open. Under these conditions, the mode switch in the reset circuit is closed and transistor T2 is saturated to keep silicon controlled rectifier (SCR) 1 clamped off. Reset Coil L1 is deenergized until SCR1 is fired.

When the trip/set circuit breaker is closed, transistor T2 turns off, and SCR1 fires to provide a ground for

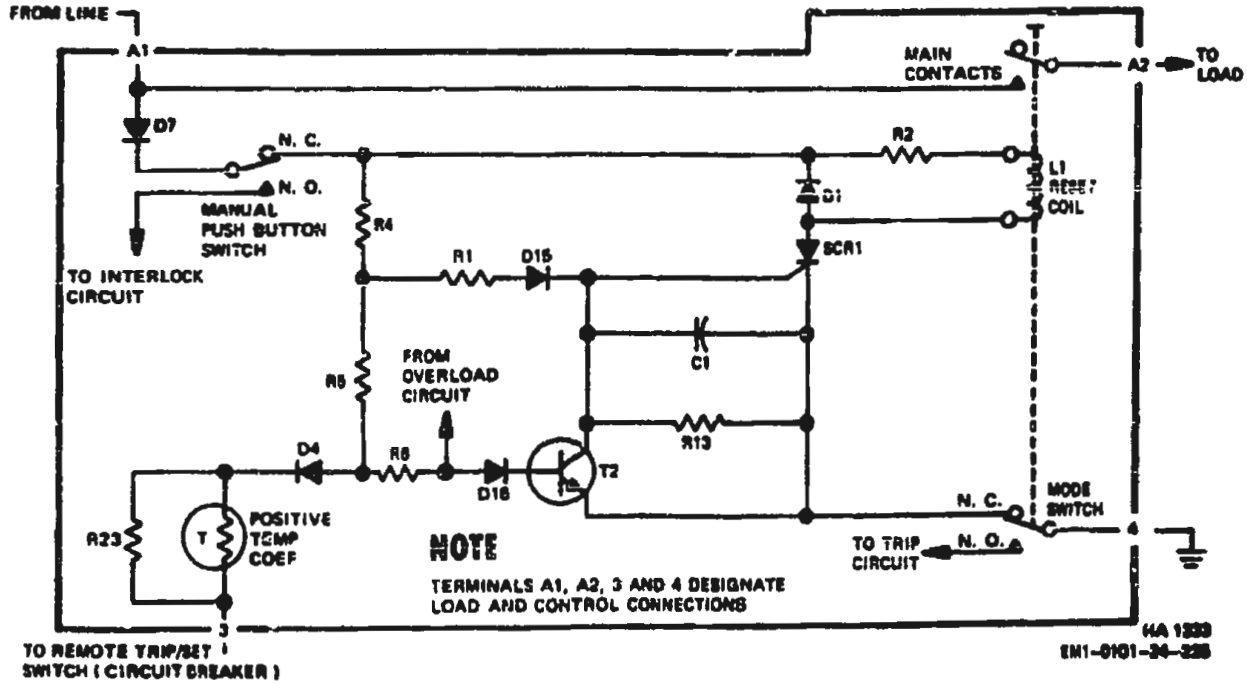


Remote Control Circuit Breaker Block Diagram
Figure 7

Coil L1 through SCR1 and the mode switch contacts. The solenoid action of coil L1 pulls the circuit breaker slide linkage to the reset position which closes the RCCB main contacts and mechanically switches the mode switch to the trip circuit position. The line voltage supply is applied to the load through the closed main contacts and the mode switch is set up for a trip cycle. If the RCCB is a 3-phase unit, all reset circuits must fire simultaneously.

(3) Trip Circuit Operation

Whenever the RCCB is in the reset position (Ref. Fig. 9) the main contacts are closed, the trip/set circuit breaker is closed, and the mode switch is in the trip circuit position. These conditions represent normal circuit breaker operation and will remain in effect until an overload occurs or a manual trip is initiated. If the trip/set circuit breaker is opened, the ground is removed from the junction of R23 and the positive temperature coefficient (PTC) resistor. The resulting positive voltage sensed at the gate of SCR2 fires the SCR to provide coil L2 with a ground path through SCR2 and the mode switch. The solenoid action of L2 pushes the circuit breaker slide linkage to the trip position which opens the circuit breaker main contacts and also



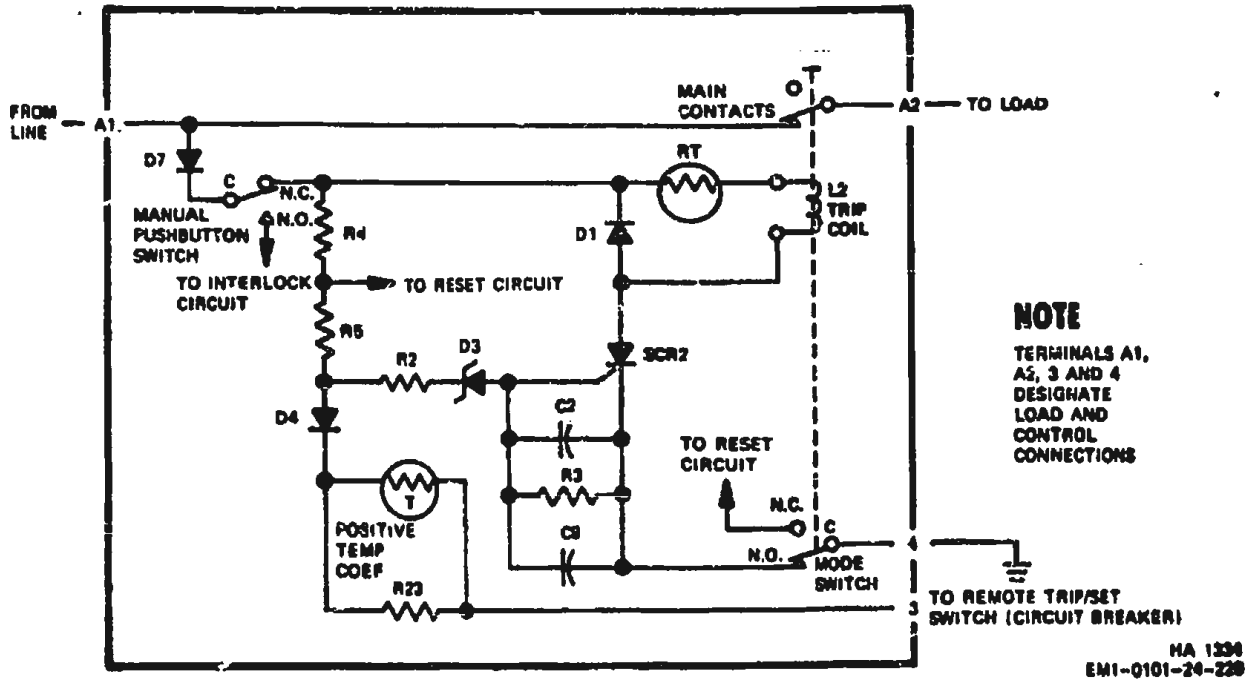
RCCB Reset Circuit
Figure 8

mechanically switches the mode switch back to the reset position. The line voltage supply is removed from the load and and the mode switch is ready for a reset cycle. If the RCCB is a three-phase device, all trip circuits must fire simultaneously.

(4) Manual Pushbutton Operation

Should maintenance activity, or other circumstances, require that the RCCB be tripped at the RCCB location, the RCCB can be tripped manually by pulling out the manual pushbutton. To ensure that the trip/set circuit breaker will have an indication that the RCCB has been tripped, an interlock circuit is activated when the pushbutton is pulled out.

When the manual pushbutton is pulled out (Ref. Fig. 10), the main contacts open to remove line voltage from the load. As the main contacts open, the pushbutton microswitch opens to remove the power supply from the trip and reset circuits and applies power to the interlock circuit. With a positive voltage applied to the interlock circuit, SCR5 fires to trigger the overload circuit causing SCR4 to fire. When SCR4 fires, the PTC current limiting resistor sends a



RCCB Trip Circuit
Figure 9

controlled currentoverload to trip the trip/set circuit breaker.

After a manual trip cycle, the RCCB can only remain reset by resetting the trip/set circuit breaker.

CAUTION: ALL FLIGHT ESSENTIAL CIRCUITS MUST BE CONTROLLABLE FROM THE FLIGHT STATION. THE RCCB MANUAL PUSHBUTTON MUST NOT BE USED TO CLOSE A CIRCUIT WHEN THE FLIGHT STATION TRIP/SET CIRCUIT BREAKER FAILS TO PERFORM THAT FUNCTION.

The RCCB manual pushbutton can be set to a mode opposite that of the trip/set circuit breaker when no power is on the RCCB, but will return to the mode of the trip/set circuit breaker when power is re-applied.

With power on the RCCB, opening the RCCB with the manual pushbutton will open the flight/station trip/set circuit breaker, requiring closure of the trip/set circuit breaker to close the RCCB. A momentary closure can also be made with power on the RCCB by pushing the RCCB manual pushbutton with the trip/set circuit breaker tripped. The RCCB will remain closed while the manual pushbutton is held in but will trip when the pushbutton is released.

(5) Overload Operation

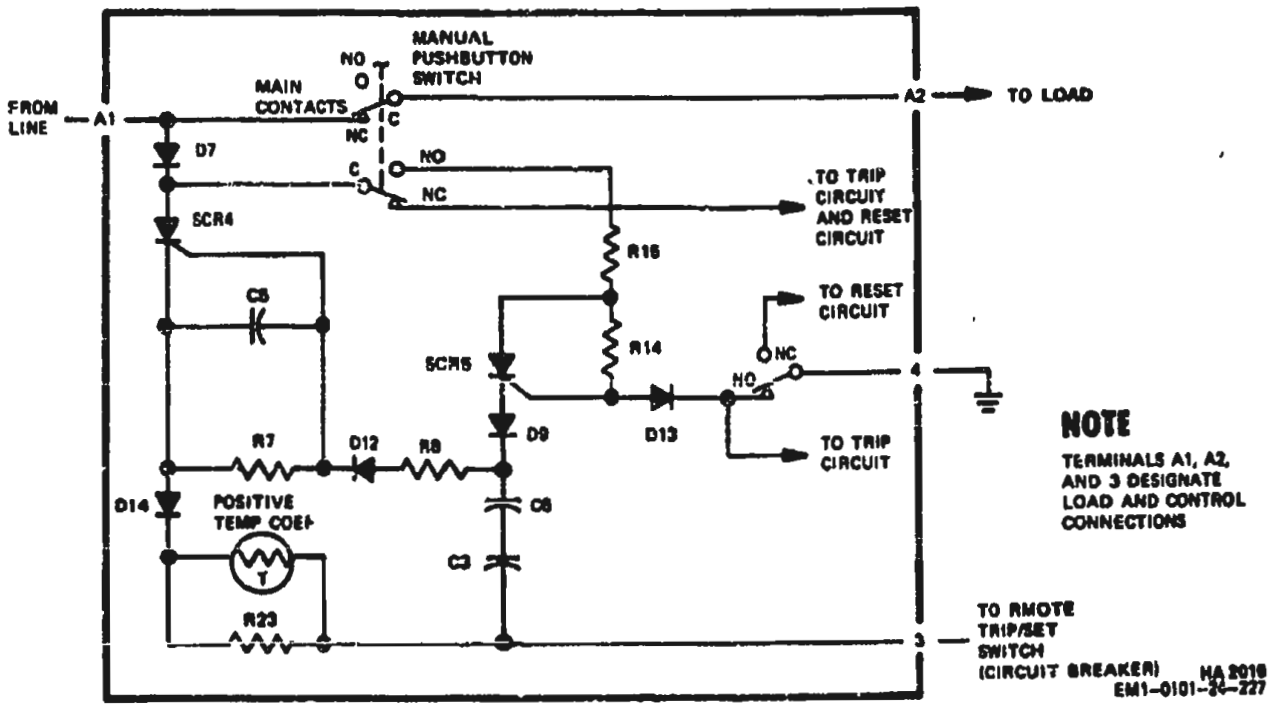
Overload operation is similar to manual pushbutton operation except that a thermal bimetal principle is used to activate the overload circuit, instead of the manual pushbutton and interlock circuit. The main contacts (Ref. Fig. 11) are closed and the trip/set circuit breaker is closed. In addition, the mode switch is set on the trip circuit and the trip/free switch is open. When the load current exceeds the RCCB rating by a specific amount for a given length of time, a bimetal deflection causes the mechanical linkage to open the main contacts and close the trip/free switch. With the trip/free switch closed, a positive voltage is applied to the overload circuit causing SCR4 to fire. When SCR4 fires the PTC current limiting resistor sends a controlled current overload to the circuit, to trip the trip/set circuit breaker. Simultaneously, trip circuit SCR2 fires and the trip circuit operates to cycle the mode switch back to the reset position. The RCCB will remain tripped until reset by the trip/set circuit breaker.

R C. LS14393-( ) and LS14394( ) Remote Control Circuit Breaker Operation

(1) General

R R R The LS14393( ) remote control circuit breaker (RCCB) is a single pole (single phase AC or DC). The LS14394 is a 3 pole (3 phase AC) combination relay and circuit breaker assembly. The RCCB (Ref. Fig. 12) can be tripped or set by applying trip or set coil current. The RCCB is used in conjunction with the 1/2 ampere circuit breaker (CB) on the FE/SO circuit breaker panel associated with the particular RCCB power circuit.

With the CB closed, and power is available to the line terminal(s) (Ref. Fig. 13), the RCCB is in a set (closed) state. With the CB open, the RCCB will be in a tripped (open) state (terminal 3 disconnected from ground). If line power is removed, the RCCB will remain in the same state as it was prior to line power removal. When power is reapplied to the line terminal(s), the RCCB will assume that state. With the RCCB set (closed) state an overload or fault will cause the RCCB to trip and in turn cause a controlled overloading of the CB, causing it to trip.



RCCB Manual Pushbutton Circuit
Figure 10

The RCCB (single pole) is a dual voltage device. The power junction (part of the electronic module) accepts 115V ac, 400Hz single phase or 28V dc. The power junction (rectifier) provides 28V dc for the RCCB electronic control circuits.

(2) Single Pole RCCB Operation.

(a) Overload Trip Indicator (OTI).

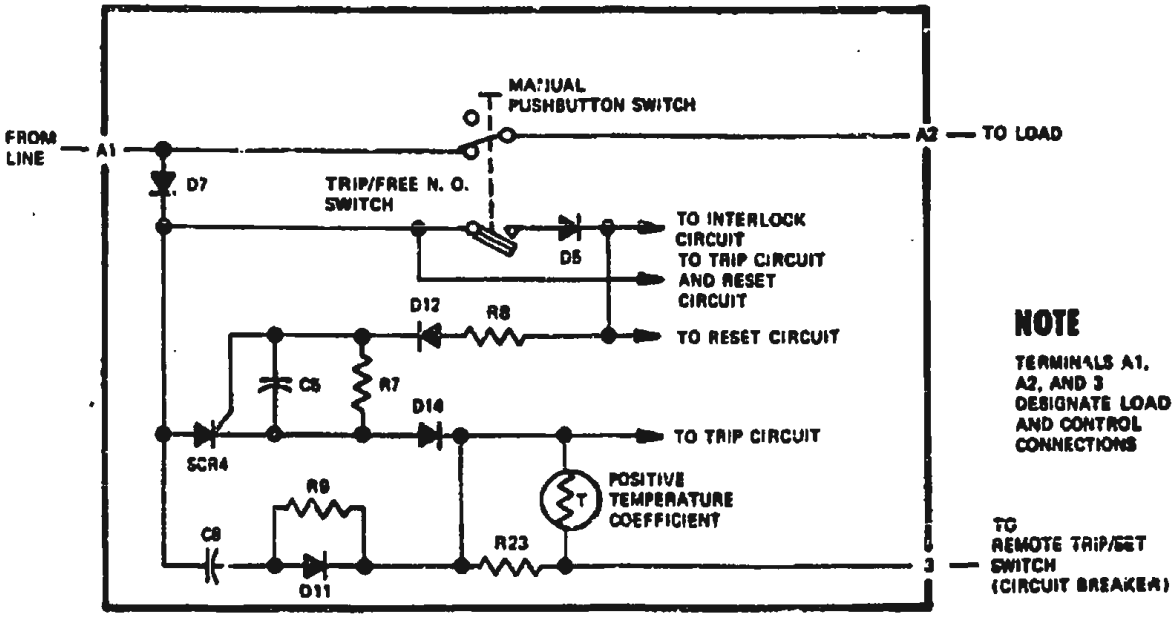
An OPEN-CLOSED visual indicator located on the right side of the Intergrated Wire Termination Module (IWTM) (Ref. Fig. 12) conector (on single pole AC or DC RCCB's) indicates the state of the RCCB contacts.

R

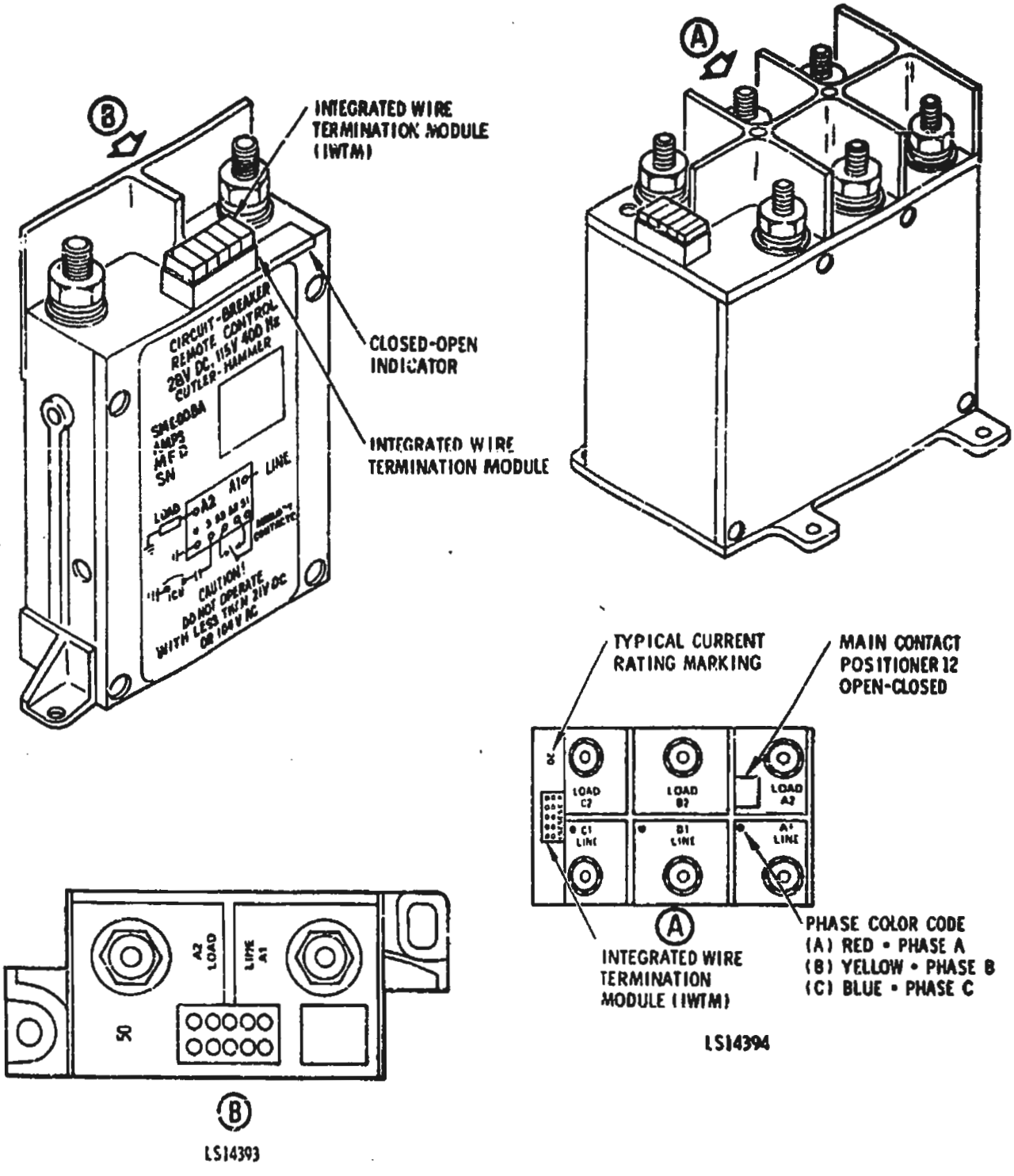
(b) Circuit Breaker and Reset.

The 1/2 ampere circuit breaker is located on the FE/SO circuit breaker panel [Ref. Fig. 14(D)]. The CB provides a remote visual indication of an overload condition, and is part of the RCCB trip-reset circuits.

When an overload occurs, the OTI contacts close and a high current (approximatley one ampere)



RCCB Overload Circuit
Figure 11



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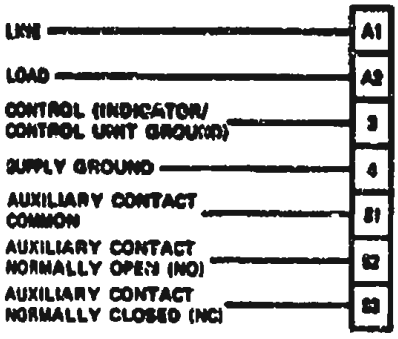
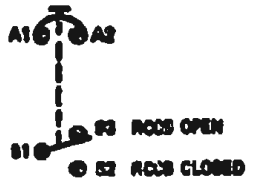
R LS14393-( ) and LS14394-( )
R Remote Control Circuit Breaker Configuration
R Figure 12

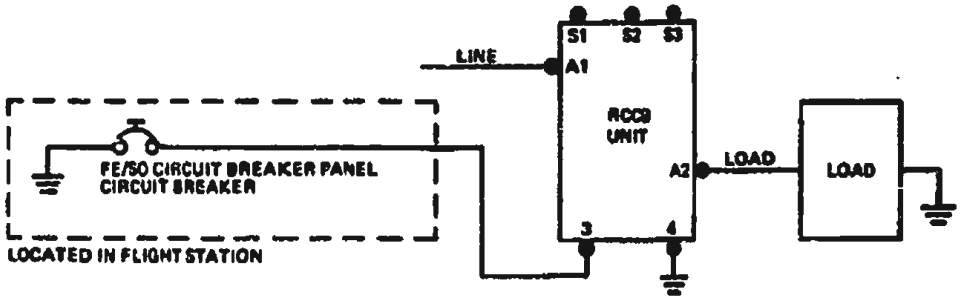
EFFECTIVITY: ALL



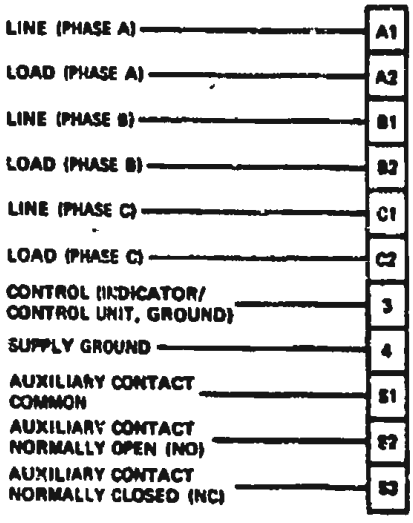
TERMINAL IDENTIFICATION



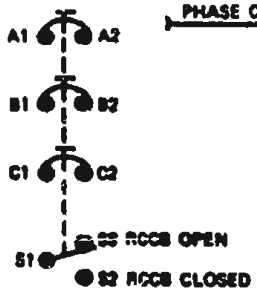
AUXILIARY CONTACT CIRCUIT (INSIDE RCCB)



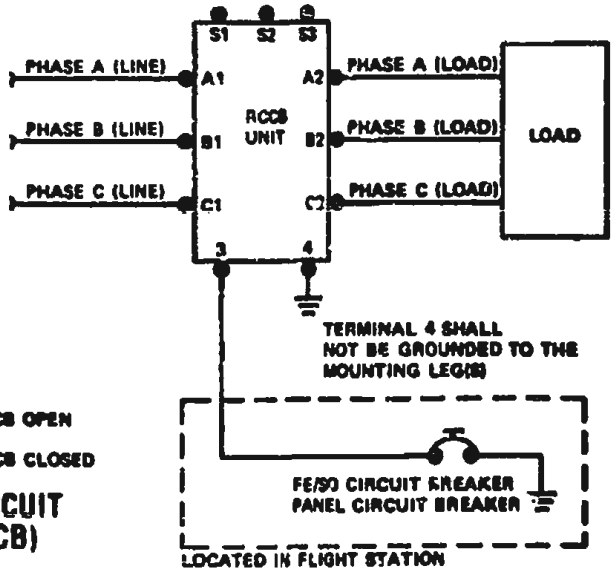
SINGLE POLE RCCB



TERMINAL IDENTIFICATION



CONTACT CIRCUIT (INSIDE RCCB)



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R LS14393-( ) and 14394-( )
R Remote Circuit Breaker Hook Up
R Figure 13

flows through the CB, tripping it open. The RCCB logic circuit resets, the set switch SCR turns off and the trip switch SCR comes on. The trip coil is energized through closed cutthroat contact B. The armature now transfers to the left pole face. Cutthroat contact A closes, and cutthroat contact B opens. The latches (latch bar I and latch H) reposition themselves (when the bimetal has cooled sufficiently). [Ref. Fig. 14(B) and (C)].

To reset the RCCB, close the CB. The logic circuit resets, and actuates the set switch SCR and turns off the trip switch SCR. As cutthroat contact A is closed and cutthroat contact B is open, the set coil is energized. The armature now transfers to the left pole face, and the cutthroat contacts are repositioned [Ref. Fig. 14(B)].

(c) A thermister is used in series with the OTI contacts to limit the current flow (during an over load condition) to approximately one ampere. A logic power supply provides the necessary logic power level for the logic circuit [Ref. Fig. 14(D)].

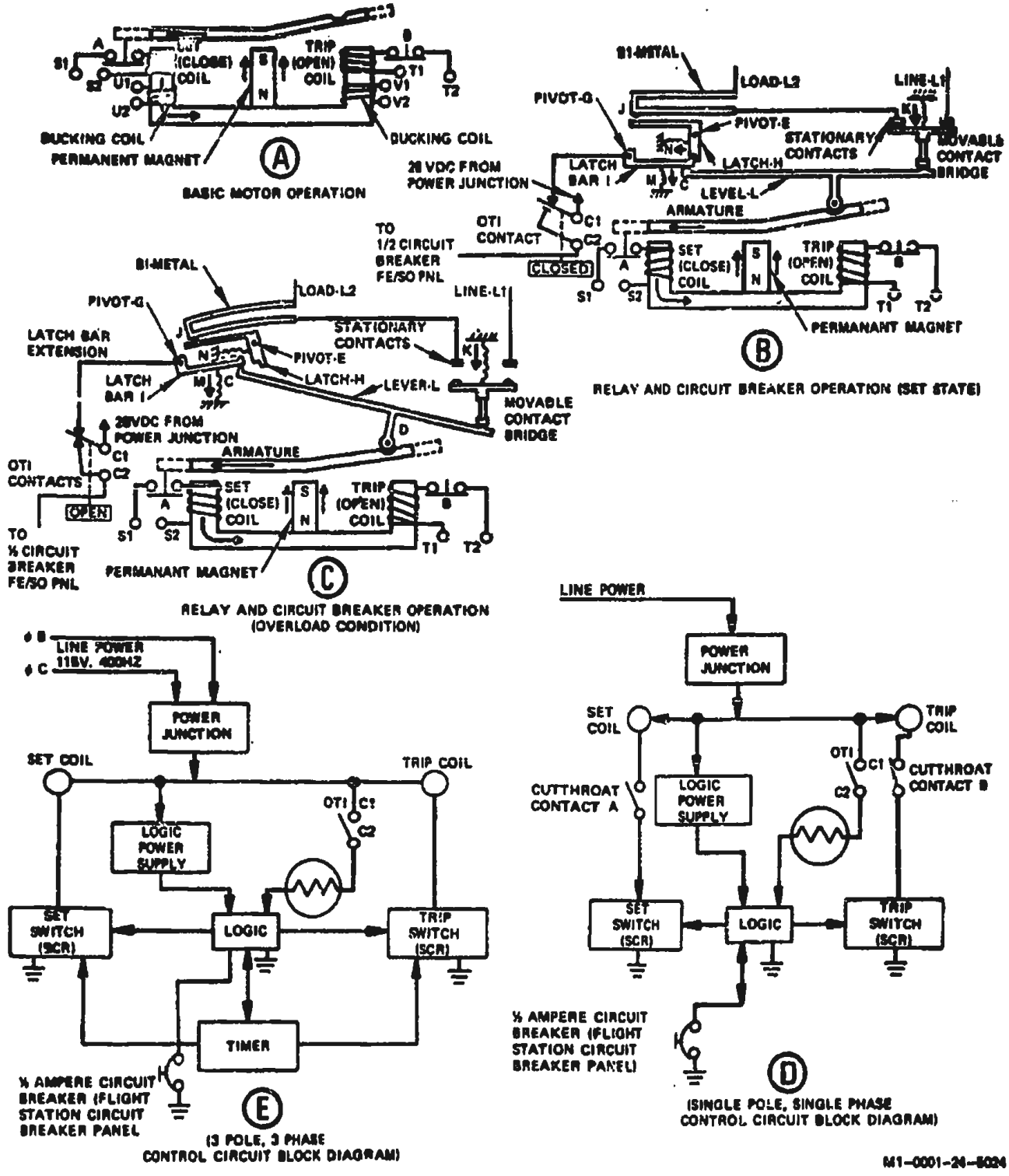
(3) 3 Pole RCCB Operation

(a) Operation and control of the 3 pole RCCB is similar to operation and control procedures employed by the single pole RCCB. The only control difference is the deletion of the cutthroats contacts. Since AC operating power is drawn from phases B and C [Ref. Fig. 14(E)], the off time between the current pulses during coil energization would cause arcing at the cutthroat contacts. The timer interfaces the logic and set-trip SCRs, and sets an on time of approximately 10-30 milliseconds, longer than the actual armature transfer time. Therefore, the coil circuits are opened electronically by the timing circuit shortly after armature transfer.

(b) The mechanical differences are; three bimetals and three sets of movable contacts are used, one for each phase, and the OTI contacts are actuated by an extension on lever L.

(4) Auxiliary Switch Contacts.

The Auxiliary switch contacts S1, S2, and S3 (Ref. Fig. 13) are actuated at the same time the OTI is actuated.



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R LS14393-( ) and LS14394-( )
R Motor and Control Operation
R Figure 14

The auxiliary switch contacts can be used to activate remote bus failure indicating lights.

4. Switchlights

A. Description and Operation

The term switchlight is used to identify an assembly consisting of a pushbutton switch and a lens cap with a backlighted legend (or bar).

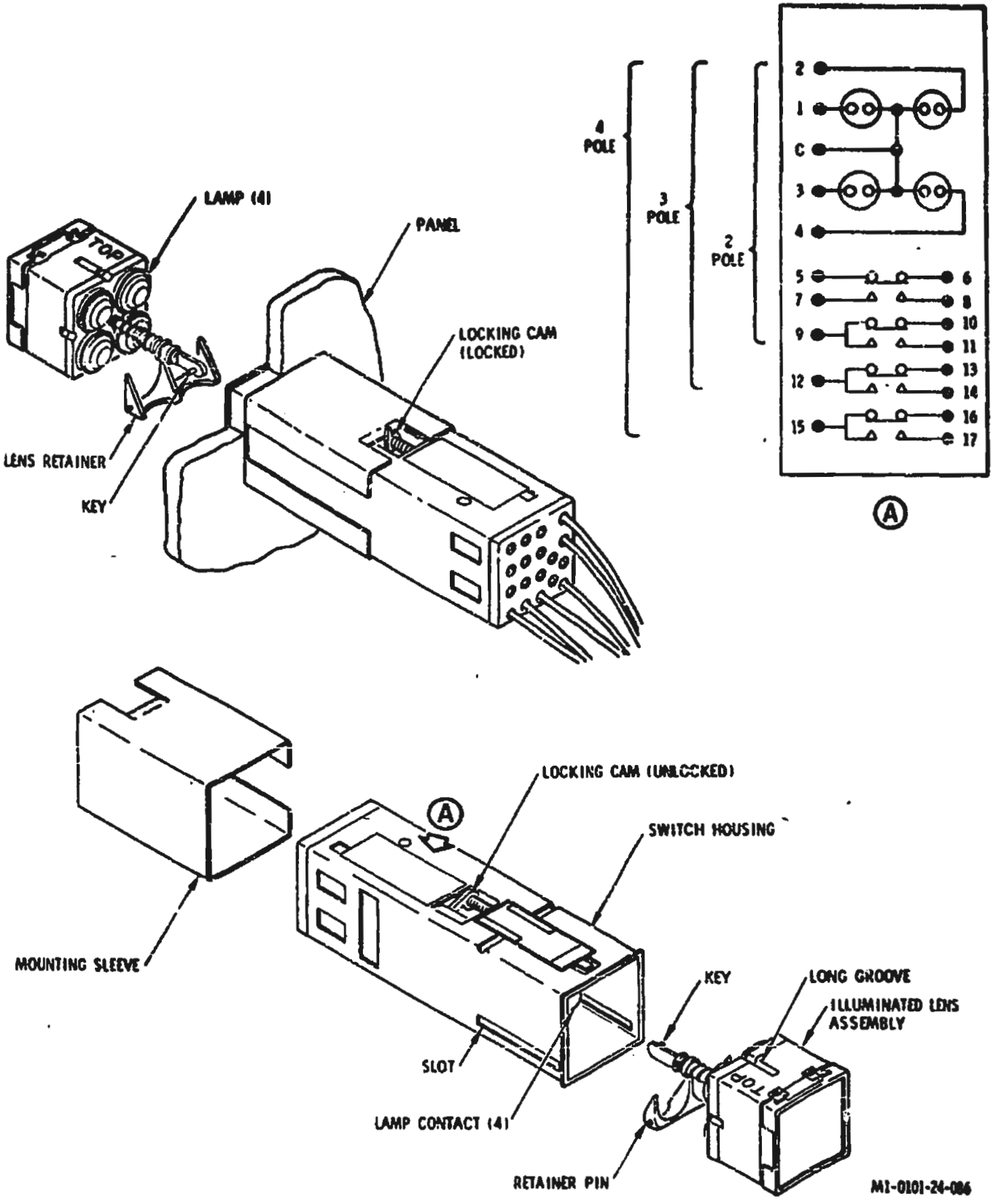
The switches are available in a four-lamp square configuration and in a two-lamp rectangular configuration. The square switch is available in two- , three- , and four-pole versions, while the rectangular switch is only available in a two-pole version. The switches are either of the momentary-type or of the push-on push-off type.

The switch housing (Ref. Fig. 15) is made of corrosion-resistant steel. The housing contains the switch contacts, the connector block, and the mount locking mechanism. The housing is inserted into the panel (from the front) through the mounting hole, and the mounting sleeve is then slid over the housing to hold it in position. Two screws, accessible with the lens assembly removed, rotate lock cams outward and then draw them against the sleeve to clamp the housing firmly to the panel.

The wires to the switchlight, which end in crimp pins, are individually installed into a pin block on the back end of the switch housing. A synthetic rubber seal prevents moisture and dirt from entering the connection. Pin sockets are numbered and connected to the switches and lights as shown in Fig. 15.

The lens assembly consists of a translucent legend that is plate-mounted in a hollow block containing miniature lamps. A spring and rod assembly on the back of the block act as the switch actuator when the lens assembly is pressed. Contacts in the switch assembly contact the base of the lamps to complete the light circuits. The lens assembly is gripped by the edges and pulled out of the switch housing to replace lamps or to gain access to the mounting lock cam screws. A plastic retainer on the actuator rod prevents the lens assembly from falling free of the housing when opened for lamp replacement.

Three types of legends are used. The first type of legend appears as white letters on an opaque background when not illuminated. When illuminated, the lettering appears in lighted white, red, green, or amber letters on the opaque



Switchlight Assembly
Figure 15

background. The second type of legend is not visible (opaque) when not illuminated. When illuminated, the legend appears in colored letters on the opaque background. Any of the four colors listed above may be used. The third type of legend is not visible either when not illuminated. When illuminated, the legend appears as black lettering on a red lighted background.

Rectangular lenses consist of only one legend. Square lenses may be divided to form two legends (split screen) to indicate more than one condition, such as ON and FAIL, or OPEN and CLOSED. Different colors and/or types of legends may be mixed on the same square lens.

ELECTRICAL POWER - MAINTENANCE PRACTICES

1. Referenced Procedures

49-00-01 Auxiliary Power Unit(APU) - Adjustment and Test

71-00-00 Power Plant - Adjustment and Test

2. Equipment and Materials

Ram Air Turbine (RAT) Ground Safety Lock, P/N 1304565

3. Maintenance Practices

These maintenance practices are abbreviated operational check procedures (actions and indications) for all electrical power systems. When additional information is needed, refer to applicable subsystems.

The following procedures assume that all applicable circuit breakers are closed and that all equipment is functioning properly. If indications obtained are not as listed, refer to the applicable subsystem.

R CAUTION: The ADI (34-21-07), THE HSI (34-55-04) AND THE RDDMI
R (34-57-08) HAVE PROVEN TO BE SUSCEPTIBLE TO HIGH
R AMBIENT TEMPERATURES. IT IS RECOMMENDED WHEN AIRCRAFT
R ARE ON THE GROUND FOR ONE HOUR OR MORE THE MASTER
R RADIO BUS SWITCHES (ESSENTIAL, AND NO. 2) BE TURNED
R OFF (BOTH LEGENDS OFF) AND THE ADI (1F2, 1F20), THE
R HSI (1F3, 1F21), THE RDDMI (1E3, 1E20) AND THE GND
R IDLE (3N2, 3N8, 3N14) CIRCUIT BREAKERS BE OPENED AND
R TAGGED UNDER THE FOLLOWING CONDITIONS:

R A. THE OUTSIDE AIR TEMPERATURE IS ABOVE 80 DEGREES F AND THE
R APU AND AT LEAST ONE AIR CONDITIONING PACK IS OPERATING.

R B. THE OUTSIDE AIR TEMPERATURE IS ABOVE 65 DEGREES F AND NO
R PACKS ARE OPERATING.

The above does not apply if the systems are needed for testing or functional checking.

R 4. Electrical Power System Operating Procedures

R CAUTION: VERIFY RAM AIR TURBINE (RAT) GROUND SAFETY LOCK (REF. 29-21-00, PAGE 201).

Table 201 covers the electrical power system operation for the following functions:

A. Application of external power to a deenergized system

B. Application of external power to a system energized by the APU

C. Application of external power to a system energized by the IDG

D. Operation of the ground service system from external power

E. Application of APU power to a deenergized system

F. Application of APU power to a system energized by external power

G. Application of APU power to a system energized by the IDG

H. Operation of the ground service system from APU power

I. Application of IDG power to a system energized by external power

J. Application of IDG power to a system energized by the APU

K. Removal of IDG power

L. Removal of APU power

M. Removal of external power

5. AC Bus Transfer System Operating Procedures

Table 202 covers the manual control of the ac bus system for the following functions:

A. Isolation of a bus from the tie bus

B. Restoration of bus-to-tie-bus connection

C. Isolation of a bus from the associated IDG

D. Restoration of bus-to-IDG connection

E. Isolation of a bus from all power

F. Restoration of power to a completely isolated bus

G. Operation of essential bus system

6. DC Conversion and Bus System Operating Procedures

Table 203 covers operation of dc conversion and bus system for the following functions:

A. Isolation of main buses

B. Paralleling of main buses

C. Isolation of a main bus from all power

D. Restoration of power to a completely isolated main bus

E. Isolation of essential bus from all power

F. Restoration of essential bus power

7. Standby Bus System Operating Procedures

Table 204 covers operation of standby bus system for the following functions:

A. Isolation of ac standby bus

B. Restoration of power to ac standby bus

C. Isolation of dc standby bus

D. Restoration of power to dc standby bus

Summary of Electrical Power System Operating Procedures
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
A.	APPLICATION OF EXTERNAL POWER TO A DEENERGIZED SYSTEM			
A1	External power receptacle	Lower right side of fuselage just aft of nose-wheel well (zone 124)	Connect external power source	None

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
A2	External power source	- - - - - - -	Energize	EXT PWR AVAIL and NOT IN USE lights on (zones 215 and 124)
A3	BATTERY switch	Electrical control panel (zone 215)	Place ON	Indicator lights on electrical control panel on
	NOTE: External Power may be applied to aircraft with BATTERY switch in OFF position.			
A4	EXT PWR switch	Electrical control panel	Place ON	EXT PWR ON light on, NOT IN USE light off, GENERATOR BREAKER switchlights indicate OPEN, TIE BREAKER switchlights indicate closed
B.	APPLICATION OF EXTERNAL POWER TO A SYSTEM ENERGIZED BY THE APU			
B1	External power receptacle	Lower right side of fuselage just aft of nose-wheel well (zone 124)	Connect external power source	None

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
B2	External power source	- - - - - - -	Energize	EXT PWR AVAIL and NOT IN USE lights on (zones 215 and 124)
B3	EXT PWR switch	Electrical control panel (zone 215)	Place ON	EXT PWR ON light on, NOT IN USE light off, APU GENERATOR BREAKER switchlights indicate OPEN, TIE BREAKER switchlights indicate closed
B4	Auxiliary power unit	Aft fuselage (control panel in zone 215)	Stop (Ref. 49-00-01)	Ref. 49-00-01 APU GENERATOR FIELD and GENERATOR BREAKER switchlights indicate OPEN
C.	APPLICATION OF EXTERNAL POWER TO A SYSTEM ENERGIZED BY THE IDG			
C1	External power receptacle	Lower right side of fuselage just aft of nose-wheel well (zone 124)	Connect external power source	None

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
C2	External power source	- - - - - - -	Energize	EXT PWR AVAIL and NOT IN USE lights on (zones 215 and 124)
C3	EXT PWR switch	Electrical control panel (zone 215)	Place ON	EXT PWR ON light on, NOT IN USE light off, GENERATOR BREAKER switchlights indicate CLOSED, TIE BREAKER switchlights indicate OPEN for operating generators, opposite indication for inoperative generators

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
C4	Engine(s)	- - - - - - -	Stop (Ref. 71-00-00)	(Ref. 71-00-00) Associated GENERATOR FIELD and GENERATOR BREAKER switchlights indicate OPEN, all TIE BREAKER switchlights indicate CLOSED
D.	OPERATION OF THE GROUND SERVICE SYSTEM FROM EXTERNAL POWER			
	Application of Power from the Flight Station			
D1	External power receptacle	Lower right side of fuselage just aft of nose wheel well (zone 124)	Connect external power source	None
D2	External power source	- - - - - - -	Energize	EXT PWR AVAIL and NOT IN USE lights on (zones 215 and 124)

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
D3	GND SERVICE switch	Electrical control panel (zone 215)	Place to EXT PWR	NO. 1/GND SERVICE BUS TIE BREAKER switchlights indicate closed, NO. 2 and NO. 3 BUS TIE BREAKER switchlights indicate off EXT PWR ON light on
	Application of Power from Attendants Forward Control Panel			
D4	External power receptacle	Lower right side of fuselage just aft of nose-wheel well (zone 124)	Connect external power source	None
D5	External power source	- - - - - - -	Energize	EXT PWR AVAIL and NOT IN USE lights on (zones 215 and 124)
D6	GND SVCE ON switchlight	Attendants forward control panel (zone 223)	Press and release	GND SVCE ON indicator light on
	Removal of Ground Service Power with Flight Station Control			

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
NOTE:	If application of full external power is desired, perform Step D7 only. If ground service power was applied from attendants forward control panel, perform Steps D8 through D11. If ground service power was applied from flight station electrical control panel, perform Steps D9 through D11.			
D7	EXT PWR switch	Electrical control panel	Place ON	All TIE BREAKER switchlights indicate closed
D8	GND SERVICE switch	Electrical control panel	Place in EXT PWR position	Attendants panel GND SVCE ON light off
D9	GND SERVICE switch	Electrical control panel	Place OFF	EXT PWR ON light off, NOT IN USE light on
D10	External power source	- - - - - - -	Deenergize	EXT PWR AVAIL and NOT IN USE lights off
D11	External power source	Lower right side of fuselage just aft of nose-wheel well	Disconnect external power source	None

Removal of Ground Service Power with Attendants Forward Control Panel

NOTE: If power was applied from flight station control, perform Steps D12 through D15. If power was applied from attendants forward control panel perform Steps D13 through D15.

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
D12	GND SVCE ON switchlight	Attendants forward control panel (zone 223)	Press and release	GND SVCE ON indicator light on
D13	GND SVCE OFF switchlight	Attendants forward control panel	Press and release	GND SVCE ON indicator light off and ground service power off
D14	External power source	- - - - - - -	Deenergize	EXT PWR AVAIL and NOT IN USE lights off
D15	External power receptacle	Lower right side of fuselage just aft of nose-wheel well	Disconnect external power source	None
	E. APPLICATION OF APU POWER TO A DEENERGIZED SYSTEM			
E1	BATTERY switch	Electrical control panel (zone 215)	Place ON	Indicator lights on panel come on
E2	Auxiliary power unit	Aft fuselage (control panel in zone 215)	Start(Ref. 49-00-01)	Ref. 49-00-01
E3	APU GENERATOR FIELD switchlights	Electrical control panel	Normal operation - none	Indicate field closed after APU is up to speed

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
E4	APU GENERATOR BREAKER switchlights	Electrical control panel	Normal operation - none	Indicate breaker closed after APU is up to speed
F.	APPLICATION OF APU POWER TO SYSTEM ENERGIZED BY EXTERNAL POWER			
F1	Auxiliary power unit	Aft fuselage (control panel in zone 215)	Start (Ref. 49-00-01)	Ref. 49-00-01
F2	APU GENERATOR FIELD switchlights	Electrical control panel (zone 215)	Normal operation - none	Indicate field closed after APU is up to speed
			If field indicates OPEN, press and release CLOSE switchlight	Field indicates closed
F3	APU GENERATOR BREAKER switchlights	Electrical control panel	Normal operation - none	Indicate breaker OPEN
F4	EXT PWR switch	Electrical control panel	Place OFF	EXT PWR ON light off, NOT IN USE light on
F5	APU GENERATOR BREAKER switchlights	Electrical control panel	Normal operation - none	Indicate breaker closed
			If breaker indicates OPEN, press and release CLOSE switchlight	Breaker indicates closed

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
F6	External power source	- - - - - - -	Deenergize	EXT PWR AVAIL and NOT IN USE lights off
F7	External power receptacle	Lower right side of fuselage just aft of nose-wheel well (zone 124)	Disconnect plug and secure access door	None
G.	APPLICATION OF APU POWER TO SYSTEM ENERGIZED BY THE IDG			
G1	Auxiliary power unit	Aft fuselage (control panel in zone 215)	Start (Ref. 49-00-01)	Ref. 49-00-01
G2	APU GENERATOR FIELD switchlights	Electrical control panel (zone 215)	Normal operation - none	Indicate field closed after APU is up to speed
			If field indicates OPEN, press and release CLOSE switchlight	Field indicates closed
G3	APU GENERATOR BREAKER switchlights	Electrical control panel	Normal operation - none	Indicate breaker closed after APU is up to speed

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
			If breaker indicates OPEN, press and release, in order given, APU GENERATOR FIELD TRIP, GENERATOR BREAKER CLOSE, and GENERATOR FIELD CLOSE switchlights	
G4	Engine(s)	- - - - - - - -	Stop (Ref. 71-00-00)	(Ref. 71-00-00) (IDG) GENERATOR FIELD and GENERATOR BREAKER switchlights indicate OPEN
	H. OPERATION OF GROUND SERVICE SYSTEM FROM APU POWER			
	To apply Ground Service Power (APU Generator assumed carrying load)			
H1	GND SERVICE switch	Electrical control panel (zone 215)	Place to APU position	NO. 1/GND SERVICE BUS TIE BREAKER switchlights indicate closed, NO. 2 and NO. 3 BUS TIE BREAKER switchlights indicate off
	To remove APU Ground Service Power			

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
	NOTE: If APU power is not needed, the ground service system will automatically return to the OFF condition as the APU is shut down (Steps H3 and H4). If APU power is desired on all buses, perform Step H2 only			
H2	GND SERVICE switch	Electrical control panel	Place OFF	All TIE BREAKER switchlights indicate closed
H3	Auxiliary power unit	Aft fuselage (shut down controls at zone 215 and external panel on lower side of fuselage at FS 1031)	Stop (Ref. 49-00-01)	Ref.49-00-01
H4	BATTERY switch	Electrical control panel	Place OFF	Panel indicator lights go off
	NOTE: Steps H3 and H4 may be reversed if desired when stopping APU from external panel to avoid having to reenter aircraft.			
I.	APPLICATION OF IDG POWER TO SYSTEM ENERGIZED BY EXTERNAL POWER			
I1	Engine(s)	- - - - - - -	Start (Ref. 71-00-00)	(Ref. 71-00-00)
I2	GENERATOR FIELD switchlights for operating engine(s)	Electrical control panel (zone 215)	Normal operation - none	Indicate field closed

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
			If any field indicates OPEN - press and release associated CLOSE switchlight	Field indicates closed
I3	GENERATOR BREAKER switchlights	Electrical control panel	Normal operation - none	Indicate closed for operating engine(s) and OPEN for nonoperating engine(s)
			If any breaker indicates OPEN for an operating engine - press and release associated CLOSE switchlight	Breaker indicates closed
I4	TIE BREAKER switchlights	Electrical control panel	Normal operation - none	Indicate OPEN for operating engine(s) and closed for nonoperating engine(s)

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
I5	EXT PWR switch	Electrical control panel	Place OFF	EXT PWR ON light off, NOT IN USE light on, all TIE BREAKER switchlights indicate closed
I6	External power source	- - - - - - -	Deenergize	EXT PWR AVAIL and NOT IN USE lights off
I7	External power receptacle	Lower right side of fuselage just aft of nose-wheel well (zone 124)	Disconnect plug and secure access door	None
J.	APPLICATION OF IDG POWER TO SYSTEM ENERGIZED BY THE APU			
J1	Engine(s)	- - - - - - -	Start (Ref. 71-00-00)	(Ref. 71-00-00)
J2	GENERATOR FIELD switchlights for operating engine(s)	Electrical control panel (zone 215)	Normal operation - none	Indicate field closed
			If any field indicates OPEN - press and release associated CLOSE switchlight	Field indicates closed

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
J3	GENERATOR BREAKER switchlights	Electrical control panel	Normal operation - none	Indicate closed for operating engine(s) and OPEN for nonoperating engine(s)
			If any breaker indicates OPEN for an operating engine - press and release in order given the associated GENERATOR FIELD TRIP, GENERATOR BREAKER CLOSE, and GENERATOR FIELD CLOSE switchlights	Breaker indicates closed
J4	TIE BREAKER switchlights	Electrical control panel	Normal operation - none	All TIE BREAKER switchlights indicate closed
J5	Auxiliary power unit	Aft fuselage	Stop (Ref. 49-00-01)	(Ref. 49-00-01) APU GENERATOR FIELD and GENERATOR BREAKER switchlights indicate OPEN

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
		K. REMOVAL OF IDG POWER		
K1	Engine(s)	- - - - - - -	Stop (Ref. 71-00-00)	(Ref. 71-00-00) All GENERATOR FIELD and GENERATOR BREAKER switchlights show OPEN, all TIE BREAKER switchlights show closed
K2	BATTERY switch	Electrical control panel (zone 215)	Place OFF	Panel indicator lights off
		L. REMOVAL OF APU POWER		
L1	Auxiliary power unit	Aft fuselage (control panel in zone 215 and an external shut-down control panel on lower side of fuselage at FS 1031)	Stop (Ref. 49-00-01)	(Ref. 49-00-01) APU GENERATOR FIELD and GENERATOR BREAKER switchlights indicate OPEN
L2	BATTERY switch	Electrical control panel (zone 215)	Place OFF	Panel indicator lights off

NOTE: Steps L1 and L2 may be reversed if desired when stopping APU from external panel to avoid having to reenter aircraft after APU shutdown.

M. REMOVAL OF EXTERNAL POWER

Summary of Electrical Power System Operating Procedures (Cont)
Table 201

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
M1	EXT PWR switch	Electrical control panel (zone 215)	Place OFF	EXT PWR ON light off, NOT IN USE light on
M2	BATTERY switch	Electrical control panel	Place OFF	Panel indicator lights off
M3	External power source	- - - - - - - -	Deenergize	EXT PWR AVAIL and NOT IN USE lights off
M4	External power receptacle	Lower right side of fuselage just aft of nose-wheel well (zone 124)	Disconnect plug and secure access door	None

Summary of AC Bus Transfer System Operating Procedures
Table 202

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
	A. ISOLATION OF A BUS FROM THE TIE BUS			
A1	Applicable TIE BREAKER TRIP switchlight	Electrical control panel (zone 215)	Press and release	TIE BREAKER switchlights for that bus indicate OPEN
	B. RESTORATION OF BUS-TO-TIE-BUS CONNECTION			

NOTE: If associated IDG is operating, perform Steps B1 through B3. If IDG is not operating, perform Step B2 only.

Summary of AC Bus Transfer System Operating Procedures (Cont)
Table 202

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
B1	Applicable GENERATOR FIELD TRIP switchlight	Electrical control panel (zone 215)	Press and release	GENERATOR FIELD and GENERATOR BREAKER switchlights indicate OPEN
B2	Applicable TIE BREAKER CLOSE switchlight	Electrical control panel	Press and release	TIE BREAKER switchlights indicate closed
B3	Applicable GENERATOR FIELD CLOSE switchlight	Electrical control panel	Press and release	GENERATOR FIELD and GENERATOR BREAKER switchlights indicate closed

C. ISOLATION OF BUS FROM THE ASSOCIATED IDG

NOTE: If IDG is not needed as a possible source of essential bus power, perform Step C1 only. If IDG is needed, perform Step C2 only.

C1	GENERATOR FIELD TRIP switchlight	Electrical control panel (zone 215)	Press and release	GENERATOR FIELD and GENERATOR BREAKER switchlights indicate OPEN
C2	GENERATOR BREAKER TRIP switchlight	Electrical control panel	Press and release	GENERATOR BREAKER switchlights indicate OPEN

D. RESTORATION OF BUS-TO-IDG CONNECTION

NOTE: If GENERATOR FIELD switchlights indicate field is closed, perform Steps D1 through D3, if field is OPEN perform Step D3 only.

Summary of AC Bus Transfer System Operating Procedures (Cont)
Table 202

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
D1	GENERATOR FIELD TRIP switchlight	Electrical control panel (zone 215)	Press and release	GENERATOR FIELD switchlights indicate OPEN
D2	GENERATOR BREAKER CLOSE switchlight	Electrical control panel	Press and release	None
D3	GENERATOR FIELD CLOSE switchlight	Electrical control panel	Press and release	GENERATOR FIELD and GENERATOR BREAKER switchlights indicate closed
	E. ISOLATION OF A BUS FROM ALL POWER			
	NOTE: If IDG is needed as a possible source of essential bus power, perform Step E1 only. If IDG is not needed, perform Step E2 only.			
E1	GENERATOR BREAKER TRIP and TIE BREAKER TRIP switchlights	Electrical control panel (zone 215)	Press and release in any order. DO NOT PRESS SIMULTANEOUSLY	GENERATOR BREAKER and TIE BREAKER switchlights indicate OPEN
E2	GENERATOR FIELD TRIP and TIE BREAKER TRIP switchlights	Electrical control panel	Press and release in any order. DO NOT PRESS SIMULTANEOUSLY	GENERATOR FIELD, GENERATOR BREAKER, and TIE BREAKER switchlights indicate OPEN
	F. RESTORATION OF POWER TO A COMPLETELY ISOLATED BUS			
	NOTE: If GENERATOR FIELD switchlights indicate the field is closed, perform Steps F1 through F4, if field is OPEN perform Steps F3 through F4.			

Summary of AC Bus Transfer System Operating Procedures (Cont)
Table 202

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
F1	GENERATOR FIELD TRIP switchlight	Electrical control panel (zone 215)	Press and release	GENERATOR FIELD switchlights indicate OPEN
F2	GENERATOR BREAKER CLOSE switchlight	Electrical control panel	Press and release	None
F3	TIE BREAKER CLOSE switchlight	Electrical control panel	Press and release	TIE BREAKER switchlights indicate closed
F4	GENERATOR FIELD CLOSE switchlight	Electrical control panel	Press and release	GENERATOR FIELD and GENERATOR BREAKER switchlights indicate closed

G. OPERATION OF THE ESSENTIAL BUS SYSTEM

NOTE: The power source for the essential ac bus is selected by a rotary switch located on the electrical control panel. The AUTO positions provide prime and secondary sources, with automatic transfer if the prime source fails. The possible combinations are: NORM B3-(G1), prime - bus 3, secondary - generator 1; B3 (G2), prime - bus 3, secondary - generator 2; G1 (G2), prime - generator 1, secondary - generator 2.

In the MANUAL positions, the essential bus is connected to the indicated source with no transfer function.

To deenergize the essential bus perform Step G1.
To reenergize the bus perform Step G2.

Summary of AC Bus Transfer System Operating Procedures (Cont)
Table 202

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
G1	AC essential bus selector switch	Electrical control panel, lower right corner (zone 215)	Select OFF	AC ESS BUS FAIL indicator light on
G2	AC essential bus selector switch	Electrical control panel, lower right corner	Select energized source, NORM B3-(G1) preferred	AC ESS BUS FAIL indicator light off

Summary of DC Conversion and Bus System Operating Procedures
Table 203

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
	NOTE: Unless the system has been manually disabled, the system is automatically energized as soon as the ac buses are energized. The following procedures cover bus isolation and paralleling, removal of power sources, and restoration of power after manual power removal.			
	A. ISOLATION OF THE MAIN BUSES			
A1	DC BUS ISOLATION switchlight	Electrical control panel (zone 215)	Press to open (latched in)	OPEN indicator in switchlight on
	B. PARALLELING THE MAIN BUSES			
B1	DC BUS ISOLATION switchlight	Electrical control panel (zone 215)	Press and release to closed (out)	OPEN indicator in switchlight off
	C. ISOLATION OF A MAIN BUS FROM ALL POWER			
C1	DC BUS ISOLATION switchlight	Electrical control panel (zone 215)	Press to open (latched in)	OPEN indicator in switchlight on

Summary of DC Conversion and Bus System Operating Procedures (Cont)
Table 203

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
C2	T/R POWER (1, 2, or 3 as applicable) circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Open	None
C3	BUS VOLTS T/R AMPS selector switch	Electrical control panel	Select isolated bus	Indication of 0 volts and 0 amps on dc meters verifies bus isolation
	D. RESTORATION OF POWER TO COMPLETELY ISOLATED MAIN BUS			
D1	DC BUS ISOLATION switchlight	Electrical control panel (zone 215)	Press and release to closed (out)	OPEN indicator in switchlight off
D2	BUS VOLTS T/R AMPS selector switch	Electrical control panel	Select applicable position	28V dc nominal reading verifies paralleling with other buses
D3	T/R POWER (1, 2, or 3 as applicable) circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Close	Amps reading on dc meter verifies TR operation
	E. ISOLATION OF ESSENTIAL BUS FROM ALL POWER			
E1	DC ESS BUS - DC TIE BUS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Open	None
E2	ESS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Open	None

Summary of DC Conversion and Bus System Operating Procedures (Cont)
Table 203

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
E3	BUS VOLTS T/R AMPS selector switch	Electrical control panel	Select ESS position	Indication of 0 volts and 0 amps on dc meters verifies bus isolation
	F. RESTORATION OF ESSENTIAL BUS POWER			
F1	DC ESS BUS - DC TIE BUS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Close	None
F2	BUS VOLTS T/R AMPS selector switch	Electrical control panel (zone 215)	Select ESS position	28V dc nominal reading verifies paralleling with other buses
F3	ESS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Close	Amps reading on dc meter verifies TR operation

Summary of Standby Bus System Operating Procedures
Table 204

CONTROL OR UNIT	LOCATION	ACTION	INDICATION

NOTE: The single-phase ac standby bus is normally energized from Phase A of the ac essential bus. If the ac essential bus fails, the standby bus automatically transfers to the standby inverter provided the BATTERY switch is in the ON position and the STANDBY POWER INSTR & RADIO switch is in the ARM position.

The dc standby bus is normally energized from the dc essential bus. Failure of the dc essential bus automatically transfers the standby bus to the battery bus, provided the BATTERY switch is in the ON position.

A three-position STANDBY POWER INSTR & RADIO switch on the eyebrow panel, zone 210, permits manual control of the transfer system. The ARM switch position (normal position) enables the ac auto transfer system. The OFF position disables the ac auto transfer system. Neither position affects the dc system. The ON position forces the transfer of both the ac and dc systems, even if the normal sources are energized and/or the BATTERY switch is in the OFF position.

A. ISOLATION OF THE AC STANDBY BUS

A1	STANDBY POWER INSTR & RADIO switch	Eyebrow panel (zone 210)	Place OFF	UNARM indicator light next to switch on
A2	AC essential bus selector switch	Electrical control panel, lower right corner (zone 215)	Select OFF	AC ESS BUS FAIL indicator light on

B. RESTORATION OF POWER TO THE AC STANDBY BUS

B1	AC essential bus selector switch	Electrical control panel, lower right corner (zone 215)	Select energized source, NORM B3-(G1) preferred	ESS AC BUS FAIL indicator light off

Summary of Standby Bus System Operating Procedures (Cont)
Table 204

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
B2	STANDBY POWER INSTR & RADIO switch	Eyebrow panel (zone 210)	Place in ARM position	UNARM indicator light next to switch off
	C. ISOLATION OF THE DC STANDBY BUS			
C1	BATTERY switch	Electrical control panel (zone 215)	Place OFF	UNARM indicator light on eyebrow panel on
C2	DC ESS BUS - DC TIE BUS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Open	None
C3	ESS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Open	None
C4	BUS VOLTS T/R AMPS selector switch	Electrical control panel	Select STBY DC BUS position	Indication of 0 volts and 0 amps on dc meters verifies bus isolation
	D. RESTORATION OF POWER TO THE DC STANDBY BUS			
D1	BATTERY switch	Electrical control panel (zone 215)	Place ON	Verify same voltage is on dc standby bus as on battery bus
D2	DC ESS BUS - DC TIE BUS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Close	None

Summary of Standby Bus System Operating Procedures (Cont)
Table 204

	CONTROL OR UNIT	LOCATION	ACTION	INDICATION
D3	ESS PWR circuit breaker	Aft circuit breaker panel CB3, (zone 215)	Close	Verify same voltage is on dc standby bus as on dc essential bus

FLIGHT ENGINEER/SECOND OFFICERS ELECTRICAL CONTROL PANEL REMOVAL AND INSTALLATION

1. Equipment and Materials

Protective caps

2. Referenced Procedures

24-32-03	Nickel-Cadmium Battery - Removal and Installation
24-41-00	External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) Ensure that external power source is deenergized and disconnected from external power receptacle (Ref. 24-41-00). Tag receptacle.

(2) Disconnect battery main connector (Ref. 24-32-03). Tag connector.

(3) Release panel fasteners on each end of control panel.

(4) Pull panel inboard on slide until stops are engaged.

(5) Disconnect and cap nine electrical connectors on rear of panel.

(6) Release quick-disconnect stop on each end of panel.

(7) Remove panel.

B. Installation

(1) Verify that battery is disconnected and that connector is tagged.

(2) Verify that external power is deenergized and disconnected from receptacle, and that receptacle is tagged.

(3) Place control panel on slide and push outboard until quick-disconnect stops are engaged.

(4) Remove protective caps and connect nine electrical connectors to receptacles on rear of panel.

(5) Push panel outboard until flush and secure panel fasteners on each end of panel.

(6) Remove tag and connect main battery connector to battery.

(7) Remove tag from external power receptacle.

(8) On next engine run, verify proper operation of all
R controls, switchlights, and indicators in the IDG oil
R temperature gauges (engine 1, 2 and 3), frequency
R meter, AC voltmeter, IDG disconnect switchlights,
R generator oil overheat light, generator field lights
R and switchlights, KW KVAR meters, and generator breaker
R lights and switchlights. All other controls,
R switchlights and indicators on Flight Engineer/Second
R Officers ELECTRICAL control panel, zone 215 may be
R checked using external power before next engine run.

INTEGRATED DRIVE GENERATOR TRANSMISSION SYSTEM DESCRIPTION AND OPERATION

1. General

The three engine-driven generators are shop-mated to mechanical transmission assemblies to form integrated drive generator (IDG) assemblies. The IDG is removed and installed as a single unit.

The transmission maintains the generator output at 400 (±4)Hz throughout the normal engine operating speed range. The transmission also supplies lubrication and cooling oil flow, (for the transmission and generator), oil temperature and low-pressure signals, and a generator underspeed signal. The IDG is self-contained except for an external oil cooler. External signals are required from the real load controller and the generator control unit for system protection and control.

2. Integrated Drive Generator (IDG) Transmission

A. Description

The transmission (Ref. Fig.1) portion of the IDG consists of the following:

Axial gear differential

Dual hydraulic pump-motor combination (hydraulic log)

Governor and speed control

Cooling/lubrication oil system

Electromechanical disconnect mechanism

R The transmission converts a variable (4530 to 9060 rpm) input to a constant 12,000 (±120)rpm output to the generator rotor. Table 1 provides the specifications of the transmission. The transmission indication system provides monitoring of oil outlet temperature, temperature rise between the oil inlet and outlet points, and indication of low oil pressure.

Integrated Drive Generator Transmission Specifications
Table 1

ITEM	CHARACTERISTIC
SPEED AND DIRECTION OF ROTATION	
Input rotation (looking toward input shaft)	Clockwise
Input speed range for constant output	4530 to 9060 rpm
Nominal output speed	12,000 rpm (400 Hz)
Output rating	144 hp (90 kw)
Overload capacity (for 5 seconds)	200 percent
R **OPERATIONAL RANGE**	
Maximum operational altitude	42,000 feet
Ambient temperature range	-65°F(-54°C) to +266°F(+130°C)
Maximum oil-in temperature (continuous operation)	250°F(121°C)
Maximum oil-in temperature (40 minutes each 8 hours)	275°F(135°C)
WEIGHTS, PRESSURES, AND CAPACITIES	
Dry weight of transmission (with quick attach-detach)	85.1 pounds
Normal charge pressure	250 to 295 psi
Normal working pressure	3070 psi
Charge pump capacity	16.5 gal/min (minimum)
Scavenge pump capacity	19.0 gal/min (minimum)
Generator scavenge pump capacity	5.75 gal/min (minimum)
Oil capacity (with generator)	8.5 US quarts (8.0440 Liters)
FILTERS	

Integrated Drive Generator Transmission Specifications (Cont)
Table 1

	ITEM	CHARACTERISTIC
R	Disposable charge and scavenge filter elements	20 microns nominal; 40 microns absolute
	PROTECTIVE DEVICES	
	Solenoid-actuated disconnect (switch in flight station)	
	Underspeed switch	
	Thermal Switch (On IDG with Sunstrand SB24-1436)	Closes at 270 ±10 degrees
	SYSTEM INDICATING DEVICES	
	Oil-in and oil-out temperature sensors (indicator in flight station)	
	Magnetic drain plug with self-closing valve	
	Filter differential pressure indicators (2)	On aircraft with Sunstrand SB24-1413, the differential pressure indicator may be either lockwired inoperative, or replaced by a blanking plate.
	Charge pressure switch	
	Disconnect indicator	
	Oil level sight glass	
	LOAD CONTROLLER	
	Average Load Division (Normal Operation)	Within 6 kw
	With APU operating	Within 9 kw
	Operating Temperature Range	-65 to 160 degrees F

B. Operation

The dual hydraulic log variable displacement pumps are driven by the input shaft through the central spur gear of the differential gearing (Ref. Fig. 1). The displacement of the pumps is variable by changing the position of wobbler plates. The pump outputs are connected directly to fixed displacement motors. Since the speed of the motor is a function of the input flow (or pump output), the pump-motor combination produces a variable speed source independent of the input speed.

The log output drives a second input to the differential gearing, which sums the input speed and the log speed. The differential output drives a flyweight governor, which controls oil pressure to the wobbler angle control. The wobbler angle control positions the pump wobbler plates to maintain a constant 12,000-rpm output. The generator rotor is coupled directly to the transmission output.

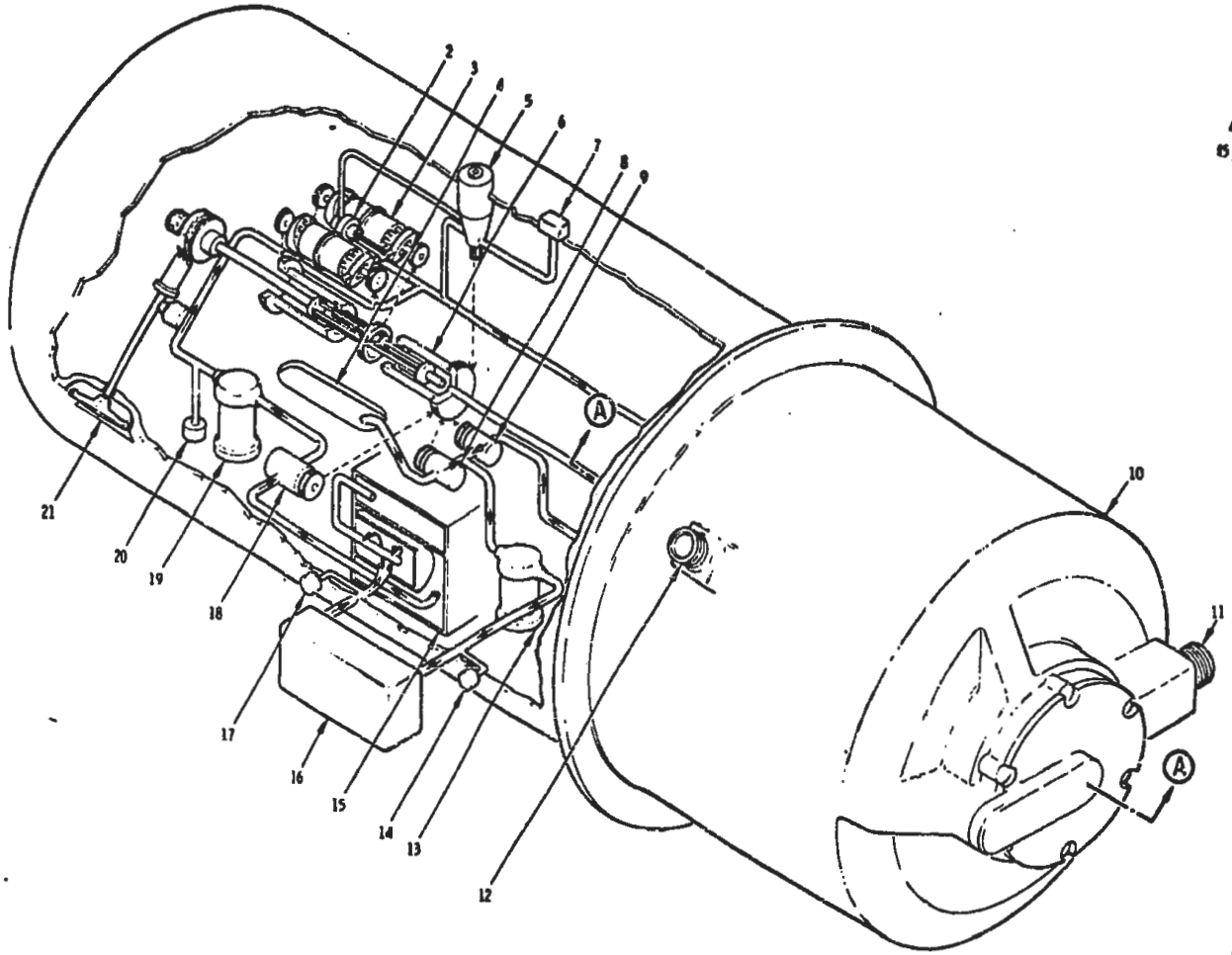
The governor (Ref. Fig. 2) is a fail-safe, temperature-compensated, flyweight-operated unit.

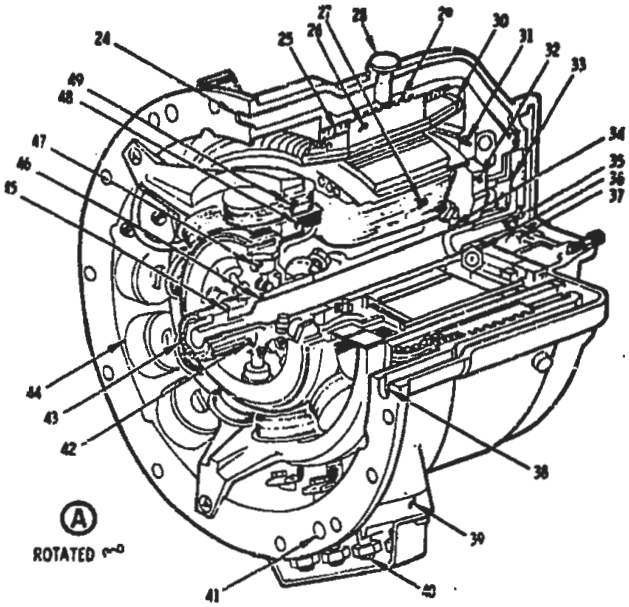
A rotating sleeve in the governor is driven from the transmission output. Flyweights pivoted on the sleeve move a valve spool against a main governor spring. An inlet port directs oil under pressure to a groove in the valve spool between two lands. As the spool moves up and down with changing output speed, oil is ported to the wobbler angle control, as needed, to maintain constant speed.

A magnetic trim coil above the flyweights is used in paralleling two or more generators. An electronic real load controller senses unequal kilowatt loadings on the generator outputs and sends a dc signal to the coil. The coil develops a magnetic field which affects the flyweights to make fine adjustments of the governor porting.

In the event of mechanical failure in the governor drive train, the flyweights stop rotating, and the valve spool will be pushed to the maximum underdrive position by the action of the main governor spring and the fail-safe spring. During this condition, the wobbler angle control is in the full-drain mode. High-pressure oil and a bias spring on the opposite side of the control force the hydraulic log to the minimum speed setting, thus preventing an overspeed of the generator.

The oil system has a reservoir with a swirl chamber for removal of entrained air. The outlet of the reservoir is placed such that it will always be under oil during normal aircraft attitudes and G-loading.





1	DELETED
2	WOBBLER ANGLE CONTROL
3	DUAL HYDRAULIC LOG
4	CASE SUMP
5	GOVERNOR (SPEED CONTROL)
6	AXIAL DIFFERENTIAL GEARING
7	UNDERSPEED SWITCH
8	CASE SCAVENGE PUMP
9	GENERATOR SCAVENGE PUMP
10	GENERATOR
11	PMG AND BEARING FAILURE CONNECTOR
12	EXCITER AND DPCT CONNECTOR
13	SCAVENGE FILTER
14	OIL OUT TEMPERATURE SENSOR
15	OIL RESERVOIR
16	OIL COOLER (AIRFRAME MOUNTED)
17	OIL IN TEMPERATURE SENSOR
18	CHARGE PUMP
19	CHARGE FILTER
20	CHARGE OIL PRESSURE SWITCH
21	DISCONNECT RESET HANDLE
22	DELETED
23	INPUT DRIVE SPLINE AND DISCONNECT
24	OIL INLET PORT
25	MAIN STATOR SPRAY NOZZLE
26	MAIN GENERATOR STATOR
27	MAIN GENERATOR ROTOR
28	STATOR RESTRICTOR NOZZLE
29	STATOR COOLING PASSAGES
30	SPLASH SHIELD
31	PMG STATOR
32	PMG ROTOR
33	BEARING FAILURE DETECTOR (DEACTIVATED)
34	SPRAY RING RESTRICTOR NOZZLE
35	TRANSFER TUBE
36	MAIN FIELD SPRAY NOZZLE
37	BEARING
38	ANTI-DRIVE END OIL SCAVENGE PORT
39	TERMINAL BLOCK
40	REPLACEABLE TERMINAL STUDS
41	DOWEL PIN HOLE
42	CROWN PILOT
43	REPLACEABLE SPLINE
44	CURRENT TRANSFORMER ASSEMBLY
45	SPLINE LUBRICANT NOZZLE
46	DIODE COOLING NOZZLE
47	ROTATING DIODE
48	EXCITER ROTOR
49	EXCITER STATOR

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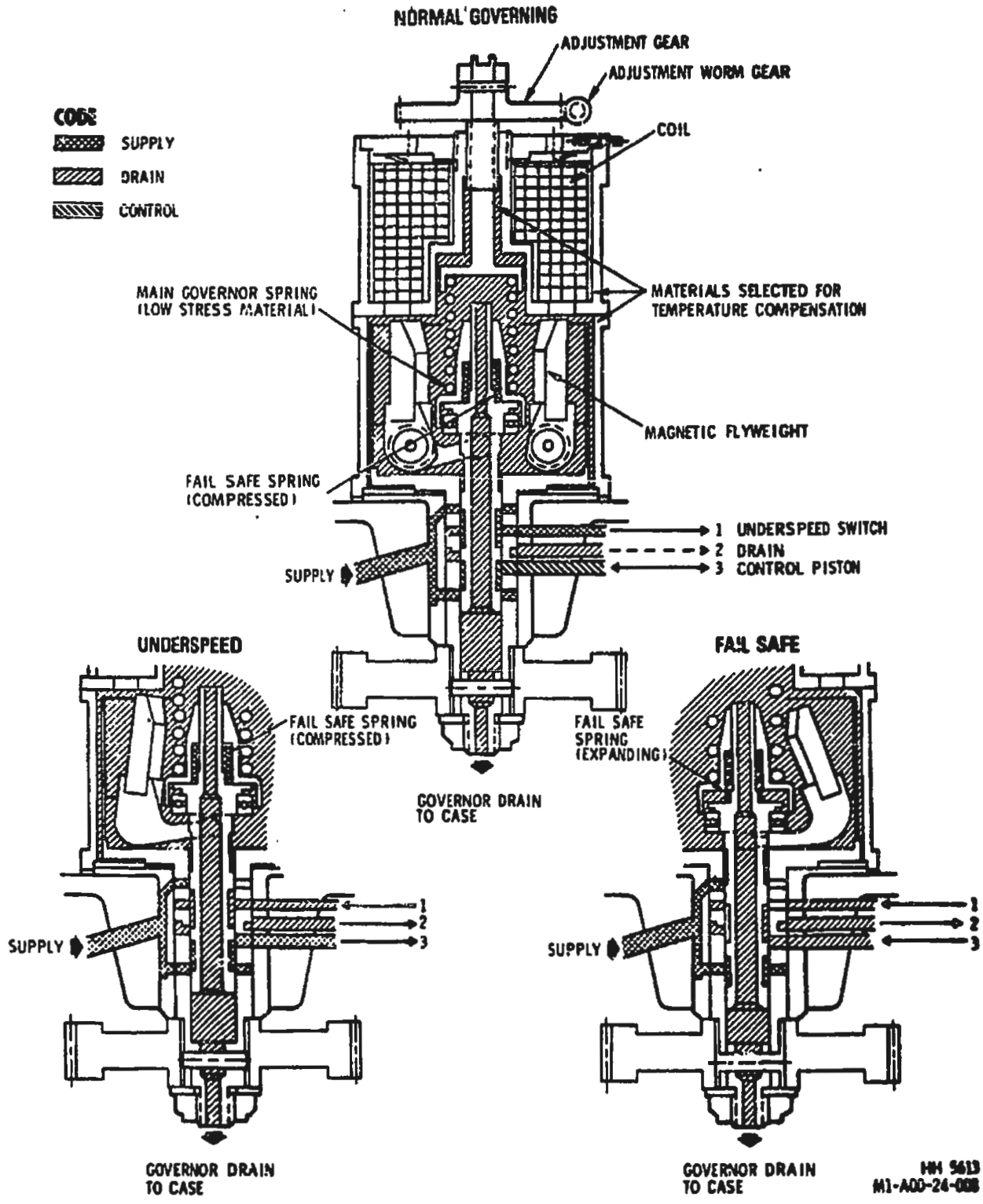
R Integrated Drive Generator Assembly
R Figure 1

EFFECTIVITY: ALL

001B



R
R

IDG Transmission Governor
Figure 2

EFFECTIVITY: ALL

A charge pump driven by the transmission output provides pressure to the hydraulic log pump inlets, the governor, the bearings, and the spray cooling system for the generator.

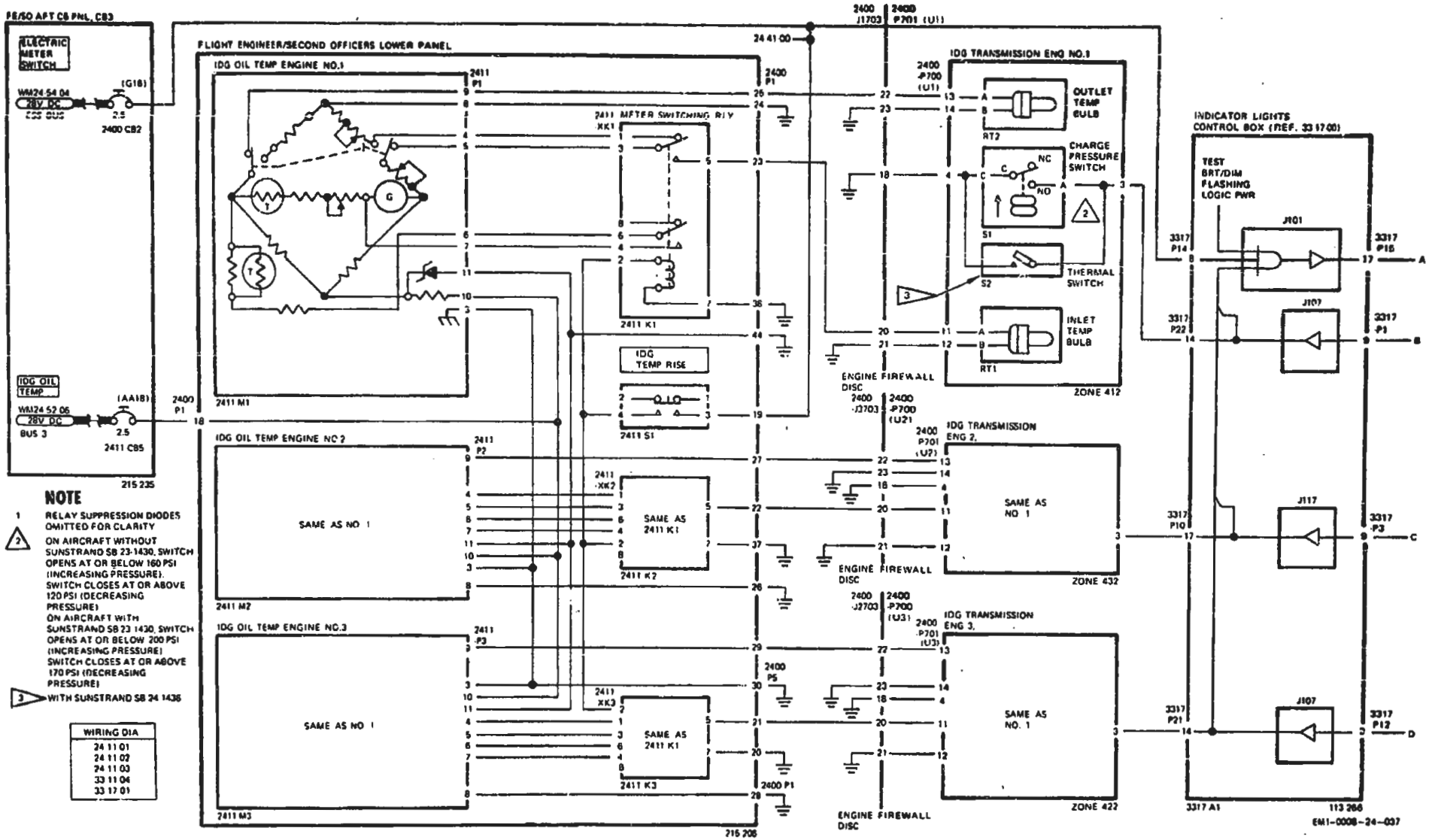
Case pressurization is required when the IDG is operated at higher altitudes, or at higher than ambient temperature. This pressurization is maintained by use of a vacuum break check valve. During normal operation, when case pressure is equal to or above atmospheric pressure, the vacuum break check valve remains closed. In this way, atmospheric air that is entrapped at low altitude is retained within the transmission case until the IDG develops a negative case pressure, or vacuum. During this condition the vacuum break check valve opens and allows atmospheric air to enter the case and replenish it's air supply. As vacuum is relieved and case pressure equalizes, the vacuum break check valve closes.

The return oil is collected in two sumps: one in the generator and one in the transmission. Oil from the sumps is picked up by two scavenge pumps, where it is filtered and passed through an external oil cooler, and then returned to the reservoir.

Oil temperature is sensed by two oil temperature sensors (oil-in and oil-out) mounted on each IDG transmission case (Ref. Fig. 3). The oil-out sensor is connected directly to the associated IDG OIL TEMP indicator on the Flight Engineer/Second Officers electrical control panel, zone 215. The sensor serves as one leg of a bridge circuit in the indicator. As the resistance of the sensor varies with the oil temperature, the balance of the bridge varies and operates a meter movement.

The oil-in sensor is connected to the normally open contact of a meter switching relay. The relay is energized by operation of the IDG TEMP RISE switch on the electrical control panel. With the relay energized, the oil-in sensor is substituted for an internal resistor in the meter bridge, and the meter reads the difference between the oil-in and oil-out temperatures. The other contacts of the meter switching relay short out a scaling resistor in the meter to change the scale factor during temperature rise operation.

Charge pump oil pressure is applied to a pressure switch which closes if the charge oil pressure is low. The pressure switch will light the LOW PRESS caution light in the associated IDG DISCONNECT switchlight on the Flight Engineer/Second Officers ELECTRICAL control panel to indicate an impending failure. At the same time, the ELECTRICAL SYSTEM annunciator light (Ref. Fig. 3) on the pilots center instrument panel, zone 210, begins to flash.



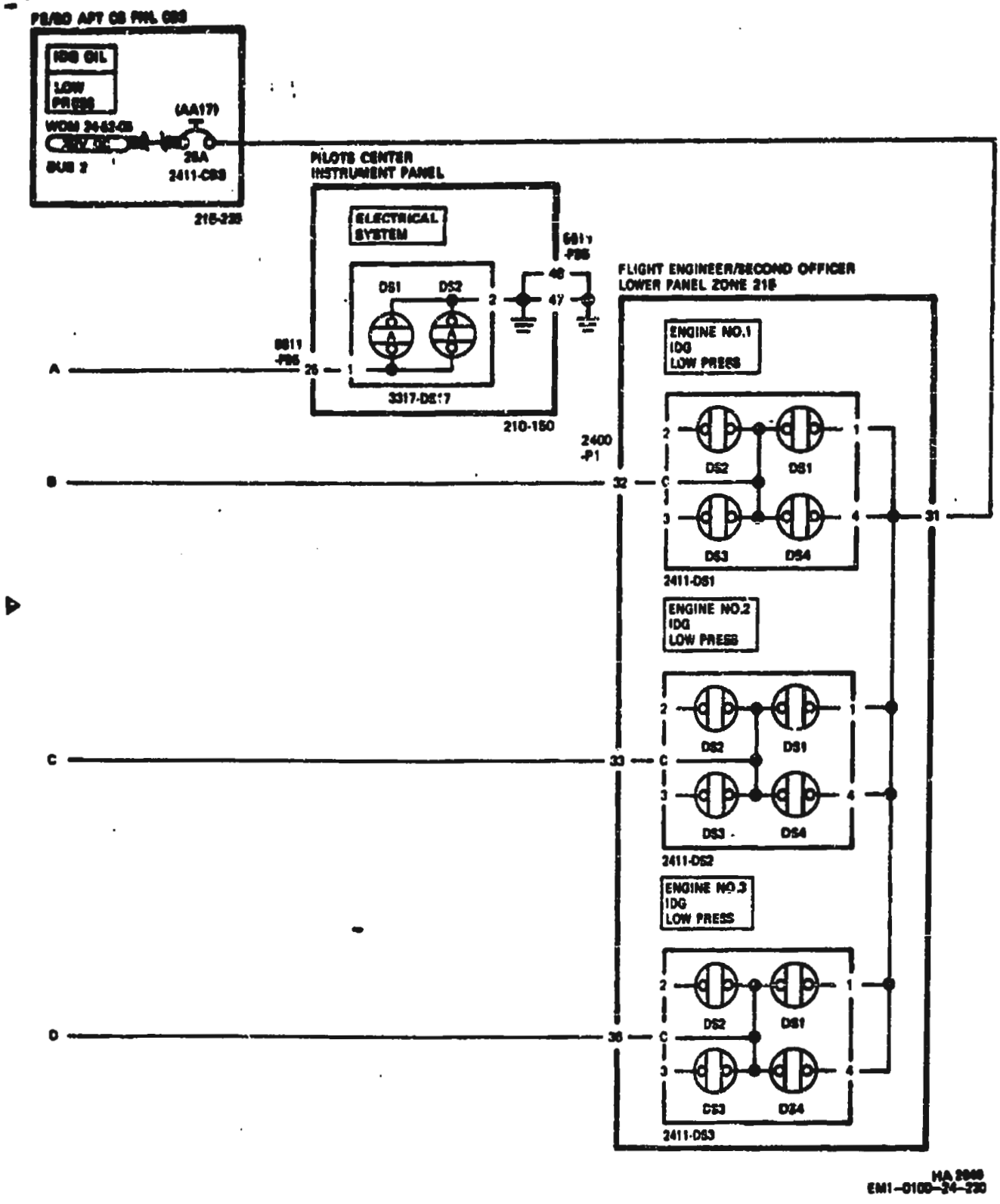
NOTE

1. RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
2. ON AIRCRAFT WITHOUT SUNSTRAND SB 23-1430, SWITCH OPENS AT OR BELOW 160 PSI (INCREASING PRESSURE). SWITCH CLOSES AT OR ABOVE 120 PSI (DECREASING PRESSURE)
   ON AIRCRAFT WITH SUNSTRAND SB 23-1430, SWITCH OPENS AT OR BELOW 200 PSI (INCREASING PRESSURE) SWITCH CLOSES AT OR ABOVE 170 PSI (DECREASING PRESSURE)
3. WITH SUNSTRAND SB 24-1436

WIRING DIA
24-11-01
24-11-02
24-11-03
33-11-04
33-17-01

R IDG Transmission Warning and Indication Functional Diagram
R Figure 3 (Sheet 1)

EFFECTIVITY: ALL



R IDG Transmission Warning and Indication Functional Diagram
R Figure 3 (Sheet 2)

Refer to 33-17-00 for description and operation of the annunciator system.

An underspeed switch, which is controlled by the governor, prevents the generator from being connected to the bus system if the speed is below limits.

Each IDG is provided with an integral, solenoid-operated, mechanical disconnect to permit the Flight Engineer/Second Officer to disconnect the IDG in the event of a malfunction. Depressing any one of the three IDG DISCONNECT switchlights energizes the solenoid and operates the associated disconnect. The disconnect (Ref. Fig. 4) consists of five basic parts:

(1) An input spline and shaft

(2) A dogtooth clutch

(3) A spring-loaded threaded pawl

(4) A control solenoid

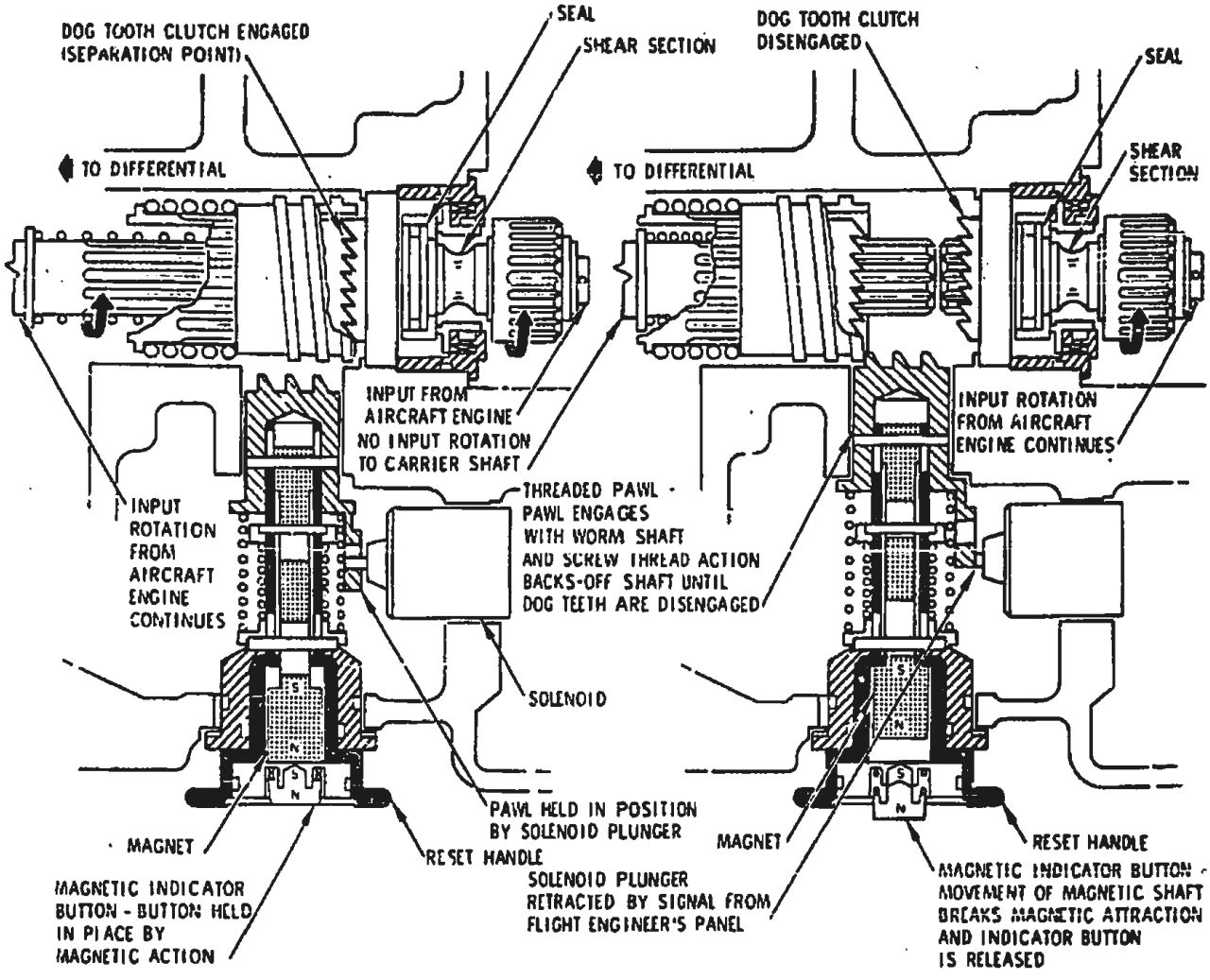
(5) A reset handle

If the solenoid is energized while the engine is stopped, the pawl engages the helical spline. Without rotation, no further action will occur. When the engine is started, the helical spline threads out until the clutch teeth disengage. However, there will not be enough inertial force in the IDG to complete the disconnection. Under the force of the return spring and engine vibration, the clutch works back into partial engagement.

CAUTION: IF THIS CONDITION IS ALLOWED TO CONTINUE, THE CLUTCH WILL BE DAMAGED AND, EVENTUALLY, DAMAGE MAY ALSO OCCUR IN THE TRANSMISSION.

If the solenoid is energized with the engine stopped, it must be reset before starting the engine.

The disconnect solenoid is reset by pulling the reset handle until the solenoid plunger in the ready position (Ref. Fig. 4). An indicator in the reset handle provides visual indication that the disconnect has been tripped. The indicator consists of a spring-loaded magnetic button in the center of the reset handle and a holding magnet inside the hollow reset shaft. With the pawl properly set, button in, the magnets hold together and overcome the spring force. When the pawl is tripped, the holding magnet moves away from the button magnet and the attraction is broken. The spring forces the button to extend from the reset handle. If it


DOG TOOTH CLUTCH ENGAGED (SEPARATION POINT)
SEAL
SHEAR SECTION
TO DIFFERENTIAL
INPUT FROM AIRCRAFT ENGINE
NO INPUT ROTATION TO CARRIER SHAFT
INPUT ROTATION FROM AIRCRAFT ENGINE CONTINUES
THREADED PAWL - PAWL ENGAGES WITH WORM SHAFT AND SCREW THREAD ACTION BACKS-OFF SHAFT UNTIL DOG TEETH ARE DISENGAGED
SOLENOID
PAWL HELD IN POSITION BY SOLENOID PLUNGER
MAGNET
RESET HANDLE
MAGNETIC INDICATOR BUTTON - BUTTON HELD IN PLACE BY MAGNETIC ACTION
SOLENOID PLUNGER RETRACTED BY SIGNAL FROM FLIGHT ENGINEER'S PANEL
MAGNETIC INDICATOR BUTTON - MOVEMENT OF MAGNETIC SHAFT BREAKS MAGNETIC ATTRACTION AND INDICATOR BUTTON IS RELEASED
POSITION OF DISCONNECT PAWL DURING NORMAL OPERATION
POSITION OF PAWL DURING DISCONNECT MODE

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R
R

IDG Disconnect
Figure 4

EFFECTIVITY: ALL

001B

R extends without having had a disconnect, the button will again hold in when pressed. If the button will not hold in, the disconnect mechanism is not properly reset.

3. Oil Filter Element

A. Description and Operation

R Two identical disposable filter elements are used on the IDG
R transmission, rated at 20 microns nominal and 40 absolute.
R The filters are on the left side of the transmission case
R and are held and sealed in place by a cap attached with
R screws.

4. Filter Bypass Valve

A. Description and Operation

Spring-loaded bypass valves are installed across the charge oil filter and the scavenge oil filter. If the filter becomes clogged to the extent that it develops 70 psi differential pressure across the element, the bypass valve will open.

The spring-loaded valve is acted on by the pressures on the input and output sides of the filter as well as the spring (Ref. Fig. 5). When the differential pressure is sufficient to overcome the spring force, the valve opens to allow oil to bypass the filter.

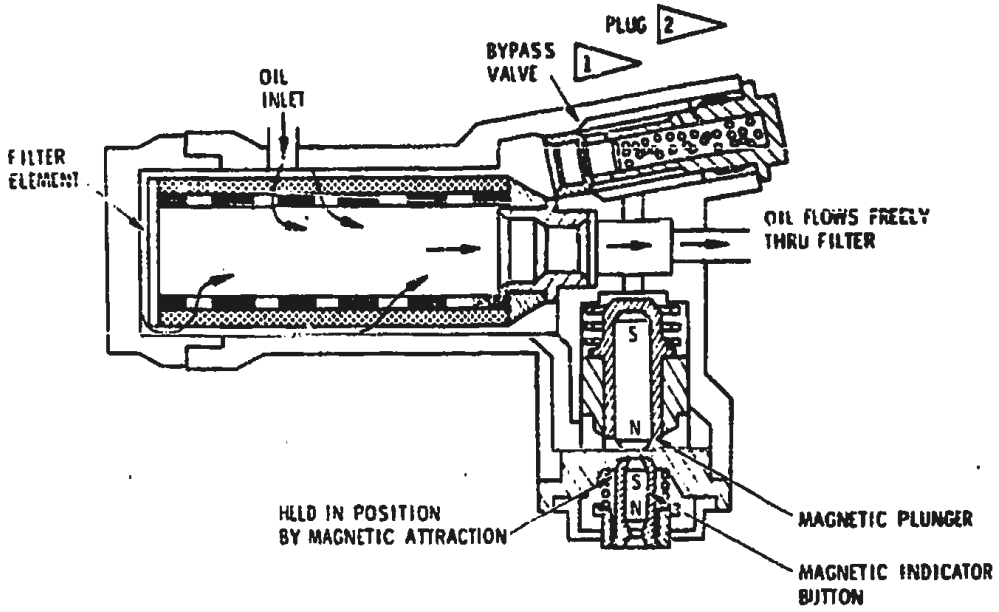
R On IDG's with Sunstrand SB24-1413,
R the charge and scavenge filter bypass valves are
R deactivated.

5. Differential Pressure Indicator

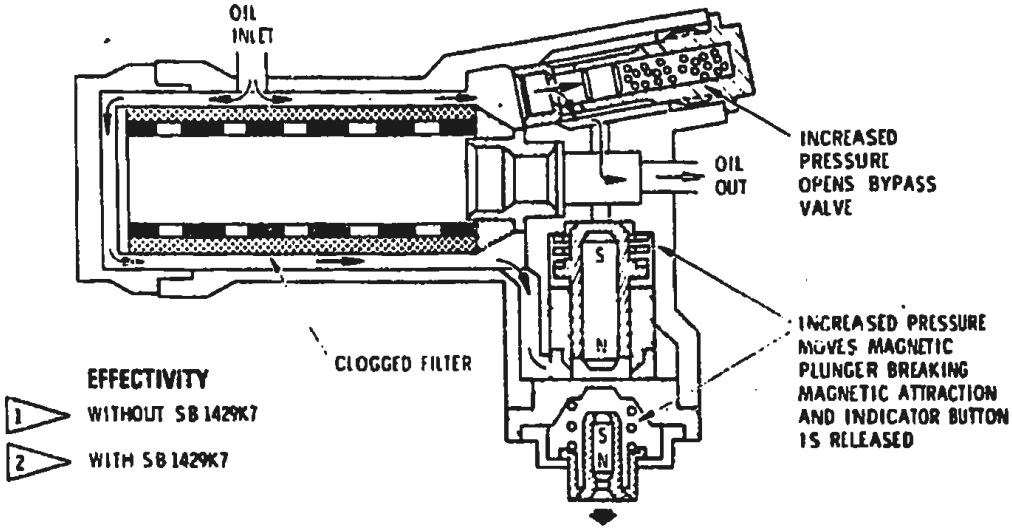
A. Description and Operation

R The differential pressure indicators, which are part of the charge and scavenge filter bypass systems, indicate when the filters are becoming clogged and require servicing, before the bypass valves have opened. The visible portion of the indicator consists of a red button which is normally flush with the indicator case. The button extends when the differential pressure across the filter exceeds 44 psi (Ref. Fig. 5).

R NOTE: On IDG's with Sunstrand SB24-1413,
R the differential pressure indicator on the charge



NORMAL OPERATION OF FILTER



FILTER BY-PASS CIRCUIT IN OPERATION

M1-0001-24-058

Operation of Filter Bypass Valve
Figure 5

R filter cap has been lockwired inoperative, or the
R indicator has been replaced by a blanking plate.

The indicator consists of a spring-loaded magnetic plunger in the filter cavity, and a spring-loaded magnetic indicator button located outside of the cavity. During normal operation, the plunger and button are held in position by magnetic attraction and by the spring force on the plunger. If the filter element becomes partially clogged, oil pressure in the cavity increases. When sufficient pressure is developed, the plunger moves away from the indicator and breaks the magnetic attraction. The spring on the button causes the button to extend to indicate the overpressure condition.

The differential pressure indicator features a temperature lockout which prevents nuisance indications caused by the pressure of the transmission oil prior to the oil reaching operating temperature. The lockout consists of a bimetal element which is adjusted to hold the pop-out button in position until the temperature increases sufficiently to move the bimetal element away from the button. Should excessive pressure drop across the filter occur during operation, the button will release.

6. Oil Temperature Sensor

A. Description and Operation

Two identical oil temperature sensors are used: one at the oil inlet and the other at the oil outlet. These sensors are conventional resistance-types which screw into bosses on the side of the transmission case.

The resistance of the sensor varies with temperature. The sensors are connected into a bridge circuit in the temperature indicator, which operates a meter movement in relation to the resistance of the sensor(s).

7. IDG Oil Temperature Indicator

A. Description and Operation

The IDG oil temperature indicator is a dual-purpose instrument providing indication of IDG oil outlet temperature or the temperature rise between the oil inlet and outlet. The indicator is contained in a standard 2-inch round instrument case, and has an electrical connector on the rear of the case. Power requirements are 28V dc
R (operating power) and 5V ac (lighting power).

The indicator face is graduated in a nonlinear scale from 0 to 180 degrees C. The scale consists of two sections: 0 to 40 degrees C for temperature rise readings, and 50 to 180 degrees C for oil outlet readings. The 40- to 50-degree section is compressed to conserve dial space. Yellow caution stripes are applied between the 25- to 40-degree and the 145- to 180-degree points.

A built-in test equipment (BITE) switch is located on the connector end of the indicator. When depressed, the switch causes the indicator to read approximately 120 degrees C for indicator testing purposes.

The meter face is illuminated by internally mounted lamps which receive power from the 5V ac panel lighting circuit. Lamps are changed by removing instrument from panel and opening dust cover on dial end of case.

8. Thermal Switch (on IDG with Sunstrand SB24-1436)

A. Description and Operation

The Thermal Switch is a normally open temperature sensative switch connected in parallel with the Charge Pressure Switch. When the oil temperature reaches 270 ±10 degrees, the Thermal Switch closes applying 28 V dc to the IDG LOW PRESS warning light on the associated IDG DISCONNECT switchlight. 28 V dc is also applied to the ELECTRICAL SYSTEM warning light on the Pilots Caution and Warning Panel.

9. Charge and Underspeed Pressure Switches

A. Description and Operation

Two identical pressure sensing switches are used for sensing IDG transmission charge oil pressure and underspeed conditions.

R On aircraft without Sunstrand SB23-1430,
R the sensing switches open below 160 psi increasing pressure,
R and reclose above 120 psi decreasing pressure.

R On aircraft with Sunstrand SB23-1430,
R the sensing switches open below 200 psi increasing pressure,
R and reclose above 170 psi decreasing pressure.

The charge pressure switch senses the charge oil pressure just downstream from the charge oil filter. When the
R pressure is 120 psi or less (on aircraft without Sunstrand

R SB23-1430), or when the pressure is 170 psi or less (on
R aircraft with Sunstrand SB23-1430), the closed contacts complete a circuit to light an associated LOW PRESS switchlight on the ELECTRICAL control panel, zone 215. At the same time, the ELECTRICAL SYSTEM annunciator light on the pilots center instrument panel, zone 210, begins to flash. Refer to 33-17-00 for description of the annunciator system.

The underspeed switch senses charge oil pressure through ports in the speed governor whenever the governor is on speed. If the speed is below a specified value, the charge oil ports close and the underspeed switch no longer senses the pressure. The switch contacts close and send a signal to the generator control unit, which removes the generator from the line.

10. Oil Level Sight Glass

A. Description and Operation

A window-type sight glass is installed on the left side of the IDG transmission. An oil level indicator plate holds the glass in place.

On aircraft without SB24-082,
three green areas on the plate (Ref. Fig. 6), one for each installation position, indicate the correct oil level.

On aircraft with SB24-082,
there are three black lines which indicate a low oil level. One for each installation position (Ref. Fig. 6).

The unit must be filled to the correct indicator according to the engine on which it is installed. The oil level must not be checked for at least 5 minutes after shutdown to allow the oil to drain back from the internal passages.

11. Oil Cooler

A. Description

The IDG transmission oil cooler (Ref. Fig. 7) is air-cooled and mounted on the lower right side of the engine low-pressure compressor (fan), zones 412, 432, and 422, for engines No. 1, 2, and 3, respectively.

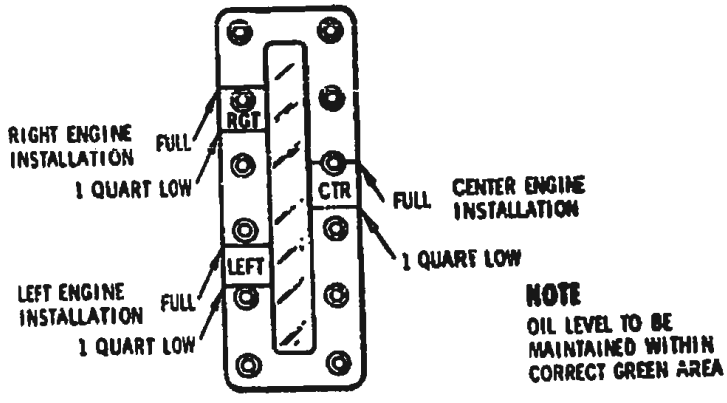
The cooler cools the IDG transmission oil system using low-pressure compressor air from the engine. The cooler is a single-pass crossflow type consisting of a matrix of

corrugated flow passages contained within a curved case which conforms to the contour of the low-pressure compressor case. The oil flow passages in the matrix are protected from ingress of foreign matter by a filter in the IDG transmission.

B. Operation

On aircraft W/O MARSTON SBD 3292-24-1, oil enters the cooler inlet connector, is pressure sensed by a relief valve, and flows through oil passages in the cooling matrix. After cooling, oil returns through a separate passage in the cooler body. Before reaching the outlet connector, oil temperature is sensed by a thermal control valve (on aircraft without MARSTON SBD3292-24-1). The functions of the thermal control valve and the pressure relief valve are combined to utilize one valve, which is positioned between the inlet and outlet connectors.

On aircraft with MARSTON SBD 3292-24-1, oil enters the cooler inlet connector, is pressure sensed by a relief valve, and flows through oil passages in the cooling matrix. After cooling, oil returns through a separate passage in the cooler body and is returned to the IDG.



Oil Level Sight Glass (Aircraft Without SB24-082)
Figure 6

The cooling air flow is taken from downstream of the low-pressure compressor. It enters the cooler by way of a diffuser duct and passes through air passages in the cooling matrix before being exhausted through the outlet duct.

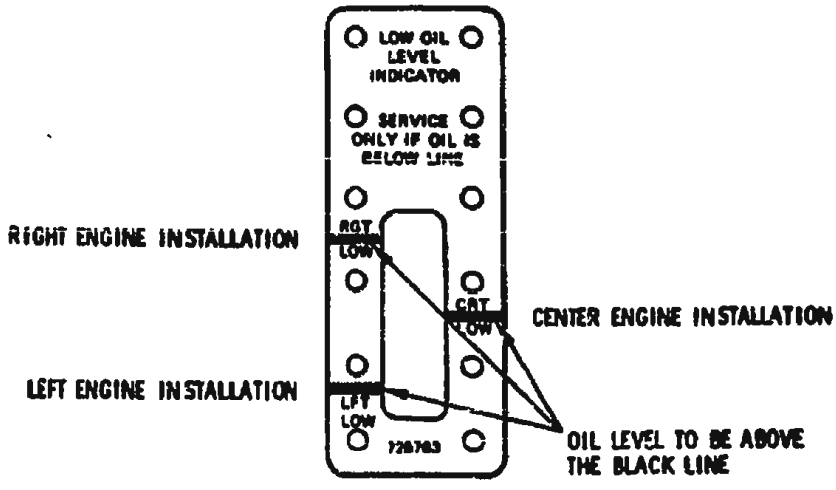
Oil flow through the cooler is controlled by the thermal control and pressure relief valve.

When the oil temperature is less than 60 degrees C (140 degrees F.) at the cooler outlet, the valve is open and the oil by-passes the cooler. As the oil temperature increases above 60 degrees C. (140 degrees F.) the valve progressively closes until at 77 degrees C (170.6 degrees F.) it is fully closed and all oil passes through the cooler. If the oil pressure exceeds a predetermined value the valve acts as a pressure relief valve and progressively opens to allow oil to by-pass the cooler and thereby protect the matrix.

12. Oil Lines and Fittings

A. Description and Operation

The IDG transmission oil cooler is connected to the IDG by two rigid steel oil lines (Ref. Fig. 7). The IDG ends of the lines are fitted with flareless end fittings to mate



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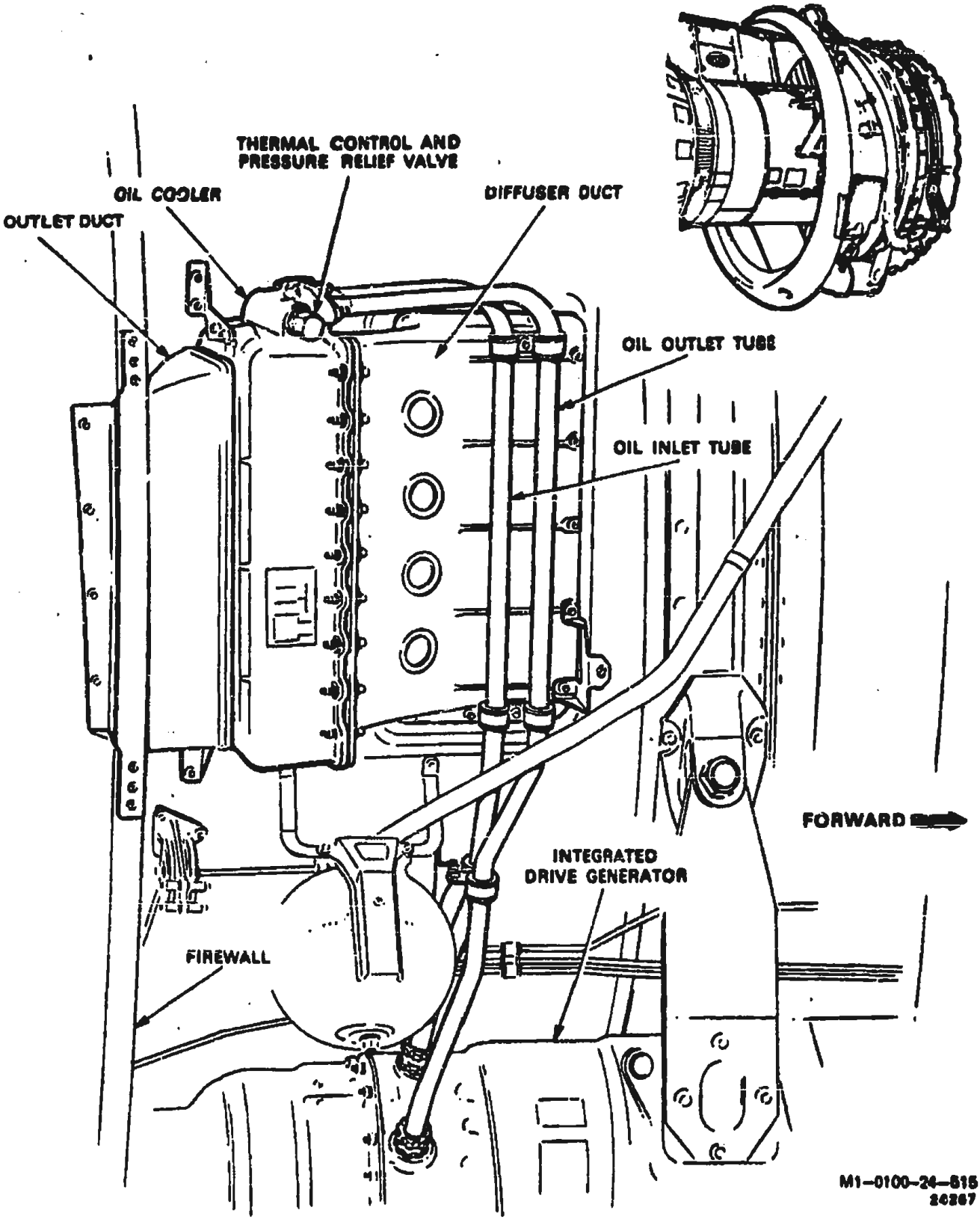
Low Oil Level Indicator Sight Glass (Aircraft with SB24-032)
Figure 6



IDG Transmission Oil Cooler and Lines
Figure 7

with unions installed in the IDG. The oil cooler ends have welded-on three-bolt flanges which bolt to pads on the oil cooler. The lines are supported by clamps and brackets along the length of the run.

13. Real Load Division Controller

A. Description

Three real load division controllers (one for each IDG), are mounted on a panel in the mid electrical service center, zone 137. The controllers operate together with the generator control current transformer assembly real load division windings and the IDG transmission governor trim heads to maintain the real loads on paralleled generators within 6 kW steady state, except during APU generator operation. The generator control current transformer assembly real load division windings sense the current in the Phase A leads of each generator. A controller is connected in parallel with each of the three IDG control current transformers (Ref. Fig. 8). Auxiliary contacts on the generator breakers (GB) and bus tie breakers (BTB) short out the current transformer-controller combination for any generator not in parallel operation.

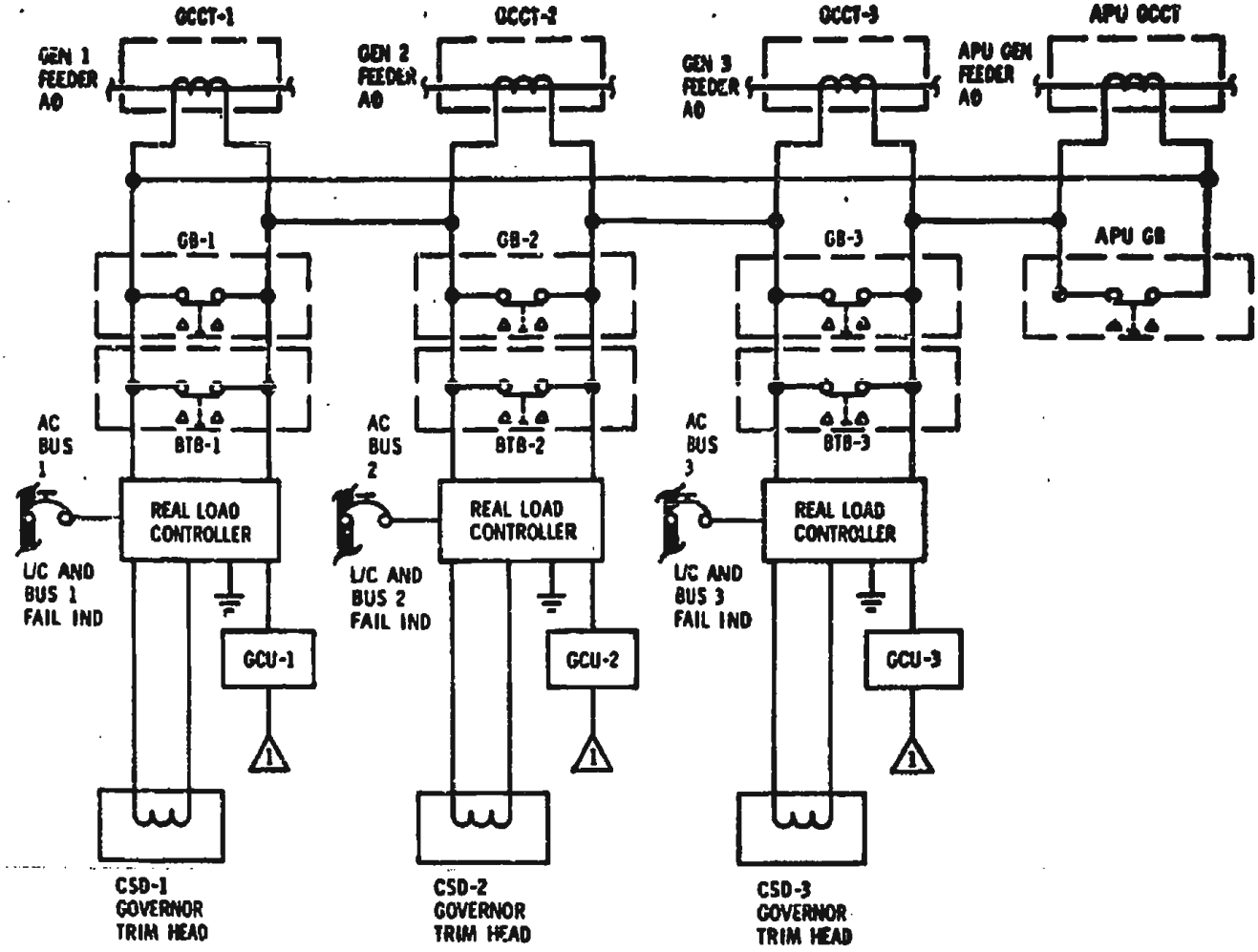
B. Operation

The controllers sense the difference with its generator load compared to the average of all paralleled generators. Each controller takes this difference signal and converts it into a proportional current, which is applied to the IDG transmission governor trim head coil. This coil sets up a magnetic field which affects the governor flyweights and attempts to change the governed speed. Since the paralleled generators tend to remain in synchronization there is no speed change, but rather a change in torque. The change in torque causes the load-hogging generator to ease back and the lightly loaded generator to take up more of the load.

There is no controller on the APU generator. When the APU generator is operating, the engine-driven generators attempt to match the APU load. In this condition, load unbalance may be as much as 9 kW. Under normal operation (engine-driven generators only) the load balance will be within 6 kW.

14. Quick Attach-detach Assembly

A. Description and Operation



NOTE

BTB - BUS TIE BREAKER

CSD - CONSTANT SPEED DRIVE

GB - GENERATOR BREAKER

GCCT - GENERATOR CONTROL CURRENT TRANSFORMER

GCU - GENERATOR CONTROL UNIT

L/C - LOAD CONTROLLER

1 FAILURE SIGNAL TO GENERATOR SYSTEM FAILURE PANEL

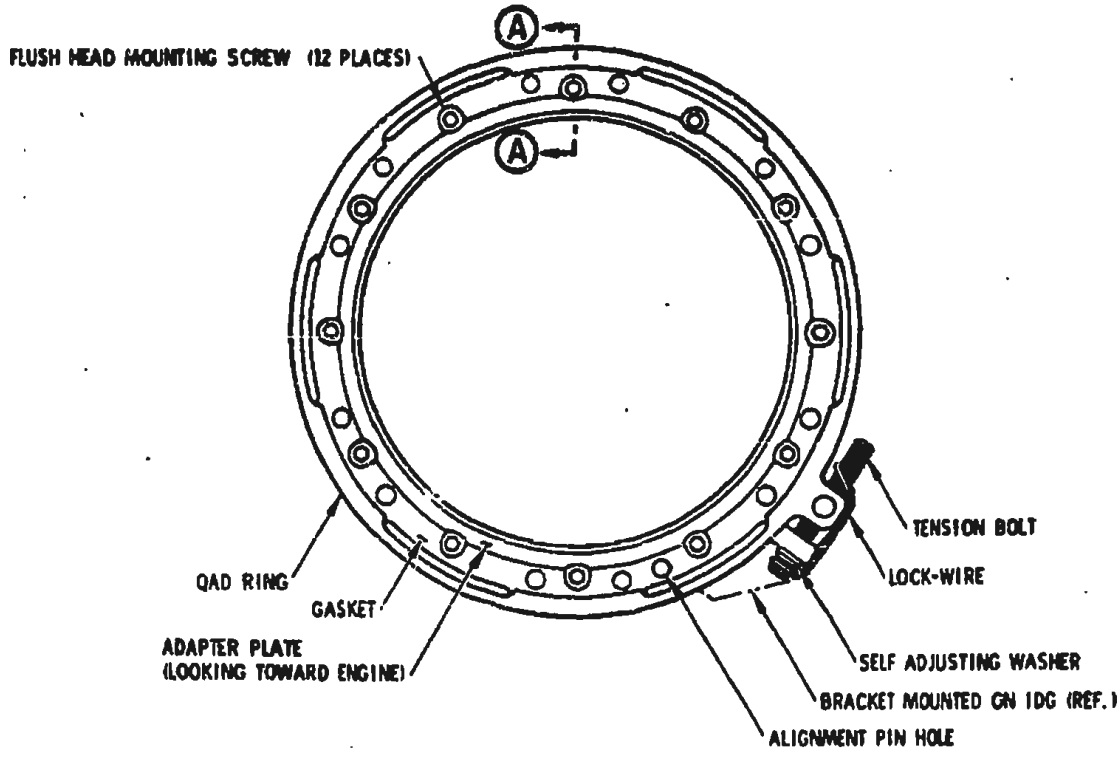
HN 8048
EM1-A00-24-067

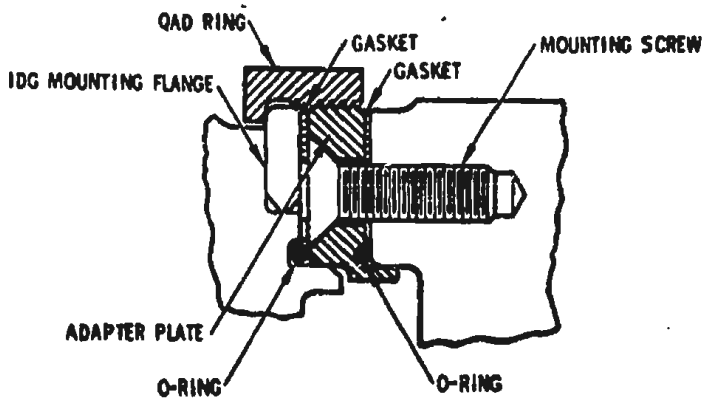
Real Load Division Controller Single Line Diagram
Figure 8

The quick attach-detach (QAD) adapter (Ref. Fig. 9) is used to mount the IDG to the engine accessory pad.

The QAD assembly is comprised of two gaskets, an O-ring, an adapter plate, and a QAD ring. The adapter plate incorporates 12 recessed holes through which mounting screws attach it to the mounting pad. A three-start right-hand thread on the outer circumference of the adapter plate provides the means by which the QAD ring can be rotated. When rotated in the clockwise direction, six flanges on the QAD ring cover the flanges on the IDG flange ring to draw and clamp the IDG to the adapter plate.

The tension bolt on the IDG and captive barrel nut on the QAD ring hold the ring in the locked position. An index pinhole located at the 5:30 clock position (as viewed from the reference point marked TOP on the adapter plate) is provided to ensure that the IDG is correctly aligned to the adapter assembly.





HH 5617
M1-0102-24-071

IDG Transmission Quick Attach-Detach (QAD) Adapter
Figure 9

INTEGRATED DRIVE GENERATOR TRANSMISSION SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found found in the Fault Isolation Reference Table in the Chapter 24 Fault Code Index. The index specifies the exact maintenance manual section, fault isoltion diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

TABLE 101

	FIGURE	TITLE
	101	Component Location Index
	102	Component Locator Diagram
	103	IDG Frequency Fault Isolation
	104	IDG Oil Pressure Legend On Fault Isolation
	105	IDG Oil Temperature Fault Isolation
	106	Aft Cabin Abnormal Vibration Fault Isolation
R	107	IDG Did Not Disconnect Fault Isolation
	SCHEM 1	IDG Oil Temperature Indicating Schematic

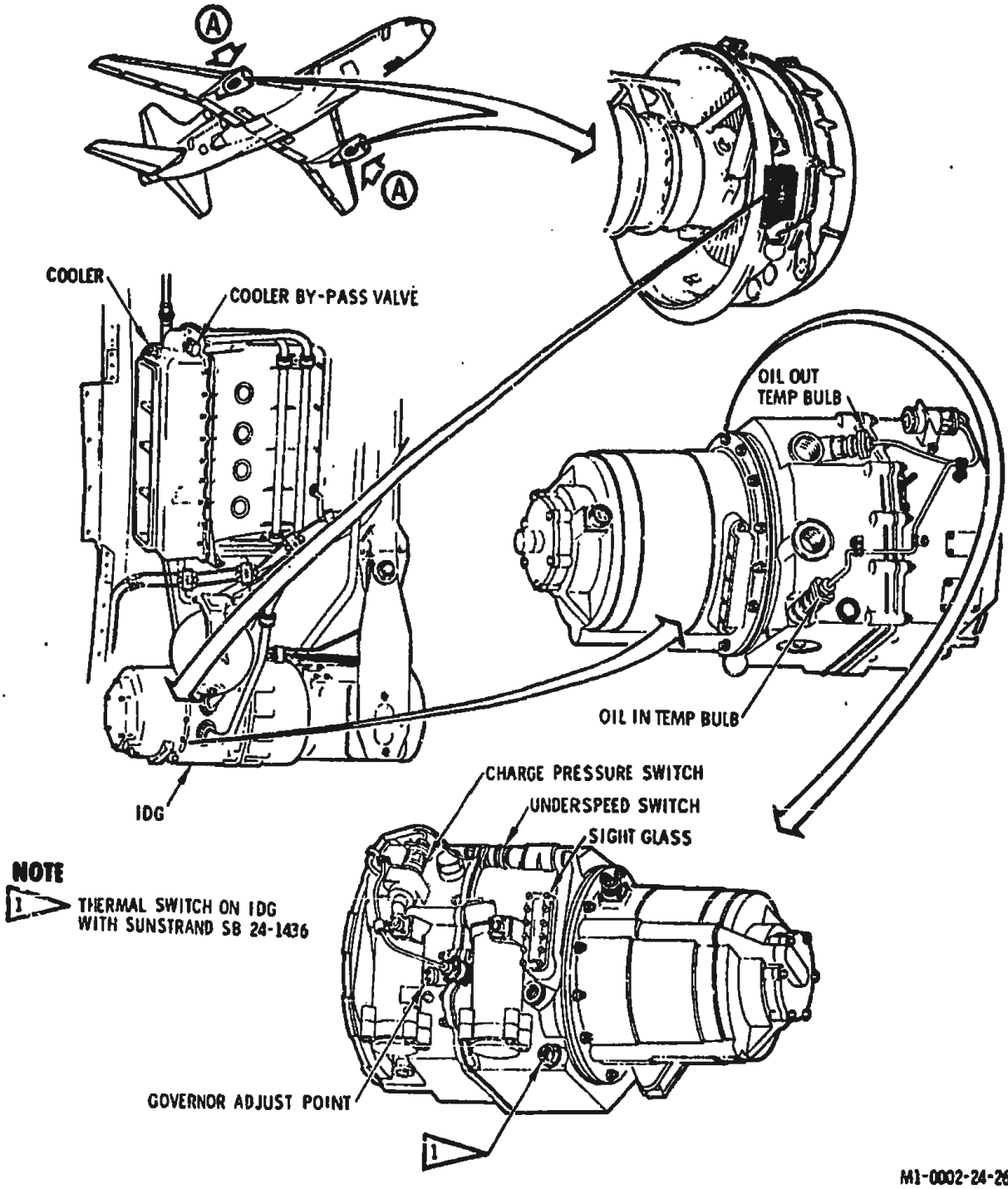
COMPONENT	QTY	AREA/ACCESS	REFERENCE
CONTROL BOX – INDICATOR LIGHTS	1	FESC; 112AB, 211CB	33-17-04
GENERATOR CONTROL UNIT – IDG's NO. 1, 2, 3	3	MESC; 192K, 137AZ	24-21-05
INTEGRATED DRIVE GENERATOR – ENGINE NO. 1	1	413A, 414A	24-11-01
INTEGRATED DRIVE GENERATOR – ENGINE NO. 2	1	433AL, 434AR	24-11-01
INTEGRATED DRIVE GENERATOR – ENGINE NO. 3	1	423A, 424A	24-11-01
INDICATOR – IDG OIL TEMPERATURE IDG NO. 1, 2, 3	3	IDG ACCESS PANELS; 413A/414A, 433AL/434AR, OR 423A/424A	24-11-10
OIL COOLER–IDG NO. 1,2,3	3	414A, 434AR OR 424A	24-11-08
SWITCH–CHARGE PRESSURE IDG NO. 1,2,3	3	413A/414A, 433AL/434AR, OR 423A/424A	24-11-06
SWITCH–THERMAL 1 IDG NO. 1,2,3	3	413A/414A, 433AL/434AR, OR 423A/424A	24-11-18
SWITCH–UNDERSPEED IDG NO. 1,2,3	3	413A/414A, 433AL/434AR, OR 423A/424A	24-11-06
TEMP BULB–OIL IN IDG NO. 1,2,3	3	413A/414A, 433AL/434AR, OR 423A/424A	24-11-05
TEMP BULB–OIL OUT IDG NO. 1,2,3	3	413A/414A, 433AL/434AR, OR 423A/424A	24-11-05

NOTE

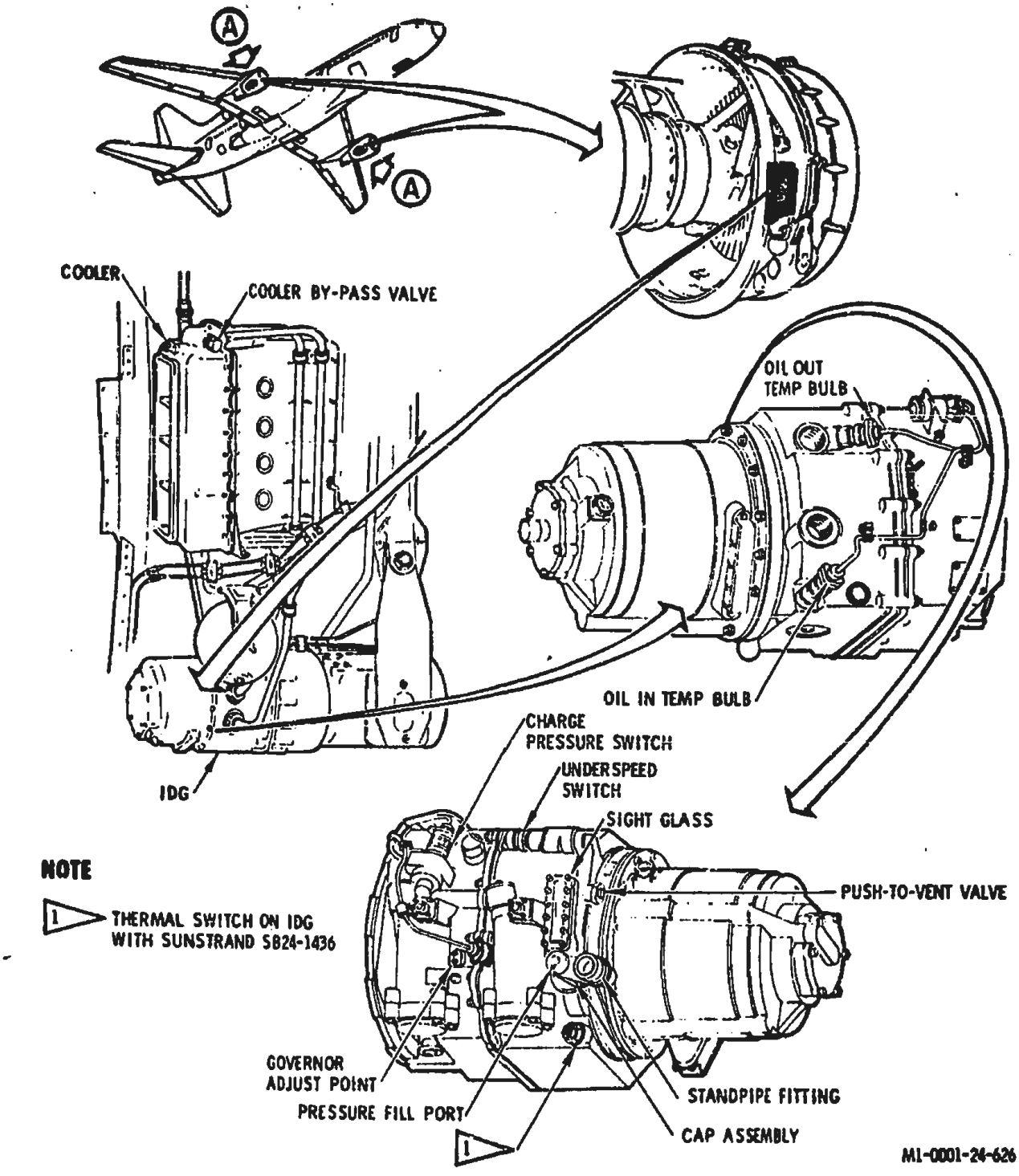
1 ON AIRCRAFT WITH SUNDSTRAND SB24-1436

M1-0001-24-5029

Component Location Index
Figure 101



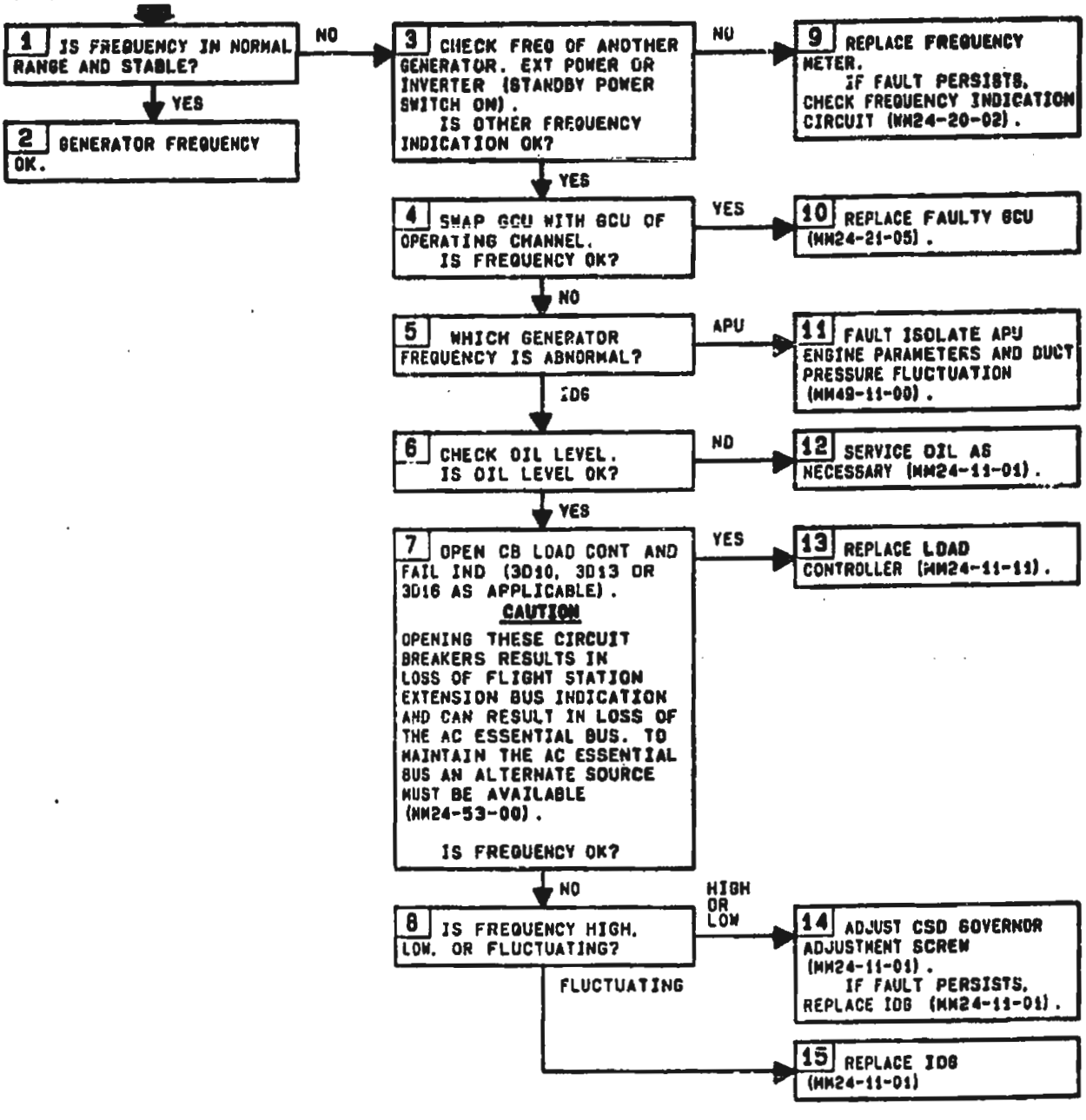
Component Locator Diagram
Figure 102



Component Locator Diagram
Figure 102

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
GENERATOR OPERATING (MM24-41-00/24-24-00)
GENERATOR LOADED (NOT PARALLELED)
CB'S IN: 1B12, 1K10, 1K15, 1K16, 1K17
1K18, 3D10, 3D13, 3D16, 3B16

GENERATOR FREQUENCY FAULT


1 IS FREQUENCY IN NORMAL RANGE AND STABLE?
NO
YES
2 GENERATOR FREQUENCY OK.
3 CHECK FREQ OF ANOTHER GENERATOR, EXT POWER OR INVERTER (STANDBY POWER SWITCH ON). IS OTHER FREQUENCY INDICATION OK?
NO
9 REPLACE FREQUENCY METER. IF FAULT PERSISTS, CHECK FREQUENCY INDICATION CIRCUIT (MM24-20-02).
YES
4 SWAP GCU WITH GCU OF OPERATING CHANNEL. IS FREQUENCY OK?
YES
10 REPLACE FAULTY GCU (MM24-21-05).
NO
5 WHICH GENERATOR FREQUENCY IS ABNORMAL?
APU
11 FAULT ISOLATE APU ENGINE PARAMETERS AND DUCT PRESSURE FLUCTUATION (MM49-11-00).
IDG
6 CHECK OIL LEVEL. IS OIL LEVEL OK?
NO
12 SERVICE OIL AS NECESSARY (MM24-11-01).
YES
7 OPEN CB LOAD CONT AND FAIL IND (3D10, 3D13 OR 3D16 AS APPLICABLE).
CAUTION
OPENING THESE CIRCUIT BREAKERS RESULTS IN LOSS OF FLIGHT STATION EXTENSION BUS INDICATION AND CAN RESULT IN LOSS OF THE AC ESSENTIAL BUS. TO MAINTAIN THE AC ESSENTIAL BUS AN ALTERNATE SOURCE MUST BE AVAILABLE (MM24-53-00).
IS FREQUENCY OK?
YES
13 REPLACE LOAD CONTROLLER (MM24-11-11).
NO
8 IS FREQUENCY HIGH, LOW, OR FLUCTUATING?
HIGH OR LOW
14 ADJUST CSD GOVERNOR ADJUSTMENT SCREW (MM24-11-01). IF FAULT PERSISTS, REPLACE IDG (MM24-11-01).
FLUCTUATING
15 REPLACE IDG (MM24-11-01)

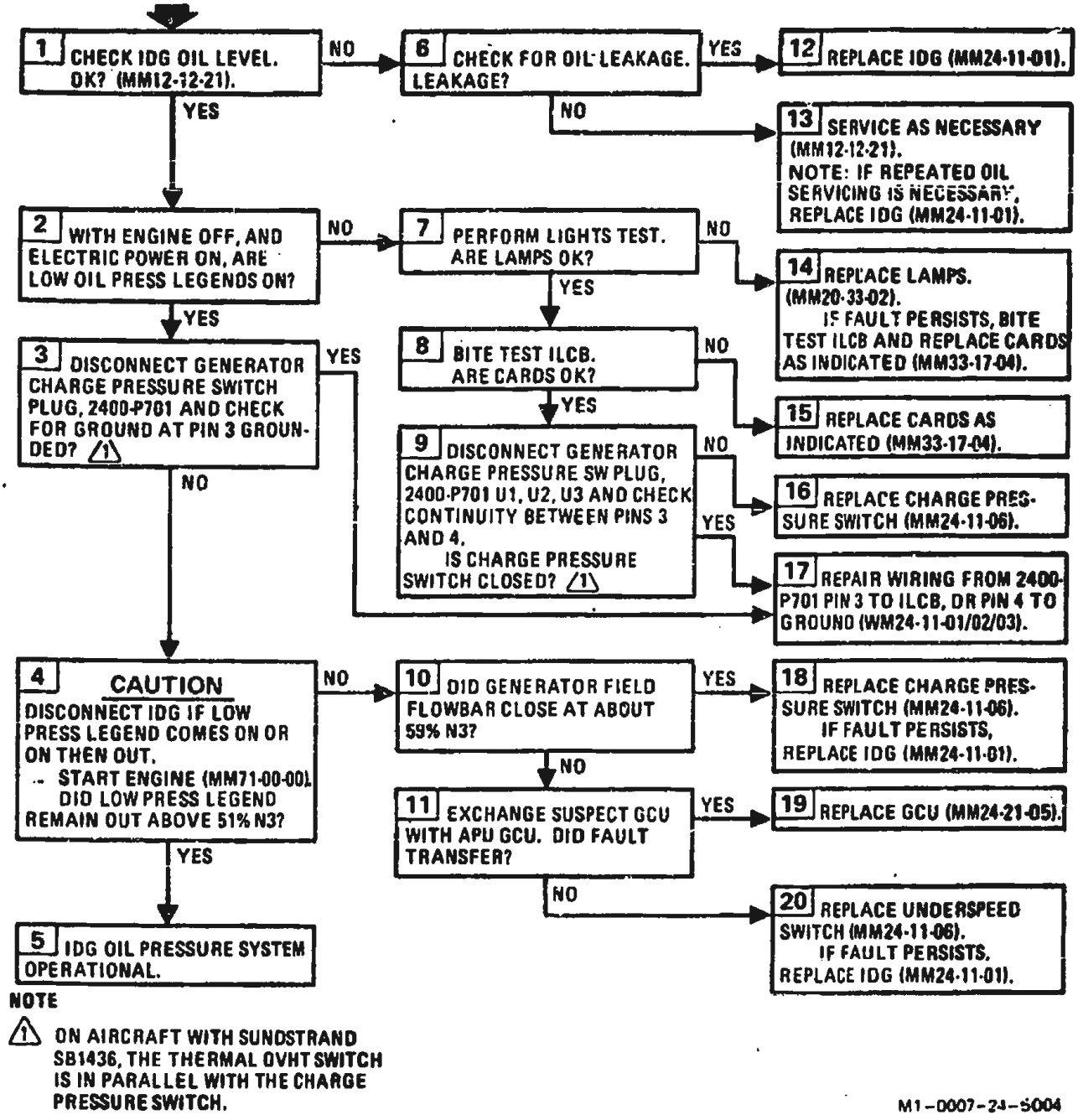
H1-0010-24-5007

IDG Frequency Fault Isolation
Figure 103

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 1K15, 1K16, 1K17, 3AA17, 3D10, 3D13, 3D18, 3G18
DO NOT RECONNECT AN IDG DISCONNECTED FOR CAUSE

IDG LOW OIL PRESSURE LEGEND ON

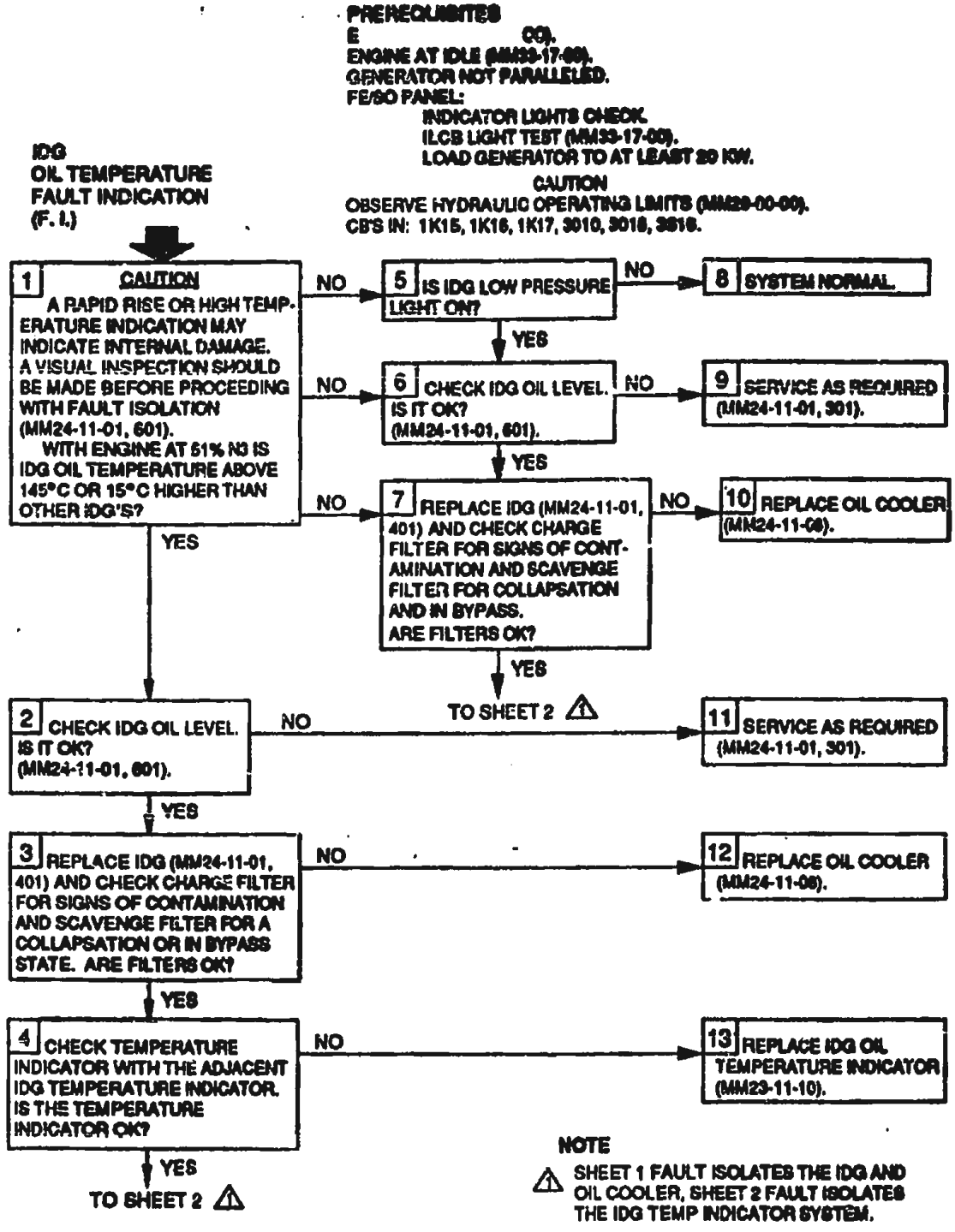

1 CHECK IDG OIL LEVEL. OK? (MM12-12-21).
NO
6 CHECK FOR OIL LEAKAGE. LEAKAGE?
YES
12 REPLACE IDG (MM24-11-01).
NO
13 SERVICE AS NECESSARY (MM12-12-21). NOTE: IF REPEATED OIL SERVICING IS NECESSARY, REPLACE IDG (MM24-11-01).
YES
2 WITH ENGINE OFF, AND ELECTRIC POWER ON, ARE LOW OIL PRESS LEGENDS ON?
NO
7 PERFORM LIGHTS TEST. ARE LAMPS OK?
NO
14 REPLACE LAMPS. (MM20-33-02). IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
YES
YES
3 DISCONNECT GENERATOR CHARGE PRESSURE SWITCH PLUG, 2400-P701 AND CHECK FOR GROUND AT PIN 3 GROUNDED? /1\
YES
8 BITE TEST ILCB. ARE CARDS OK?
NO
15 REPLACE CARDS AS INDICATED (MM33-17-04).
YES
9 DISCONNECT GENERATOR CHARGE PRESSURE SW PLUG, 2400-P701 U1, U2, U3 AND CHECK CONTINUITY BETWEEN PINS 3 AND 4. IS CHARGE PRESSURE SWITCH CLOSED? /1\
NO
16 REPLACE CHARGE PRESSURE SWITCH (MM24-11-06).
YES
17 REPAIR WIRING FROM 2400-P701 PIN 3 TO ILCB, OR PIN 4 TO GROUND (WM24-11-01/02/03).
NO
4 CAUTION DISCONNECT IDG IF LOW PRESS LEGEND COMES ON OR ON THEN OUT. - START ENGINE (MM71-00-00). DID LOW PRESS LEGEND REMAIN OUT ABOVE 51% N3?
NO
10 DID GENERATOR FIELD FLOWBAR CLOSE AT ABOUT 59% N3?
YES
18 REPLACE CHARGE PRESSURE SWITCH (MM24-11-06). IF FAULT PERSISTS, REPLACE IDG (MM24-11-01).
NO
11 EXCHANGE SUSPECT GCU WITH APU GCU. DID FAULT TRANSFER?
YES
19 REPLACE GCU (MM24-21-05).
NO
20 REPLACE UNDERSPEED SWITCH (MM24-11-06). IF FAULT PERSISTS, REPLACE IDG (MM24-11-01).
YES
5 IDG OIL PRESSURE SYSTEM OPERATIONAL.

NOTE

/1\ ON AIRCRAFT WITH SUNDSTRAND SB1436, THE THERMAL OVHT SWITCH IS IN PARALLEL WITH THE CHARGE PRESSURE SWITCH.

M1-0007-24-S004

IDG Low Oil Pressure Legend On Fault Isolation
Figure 104

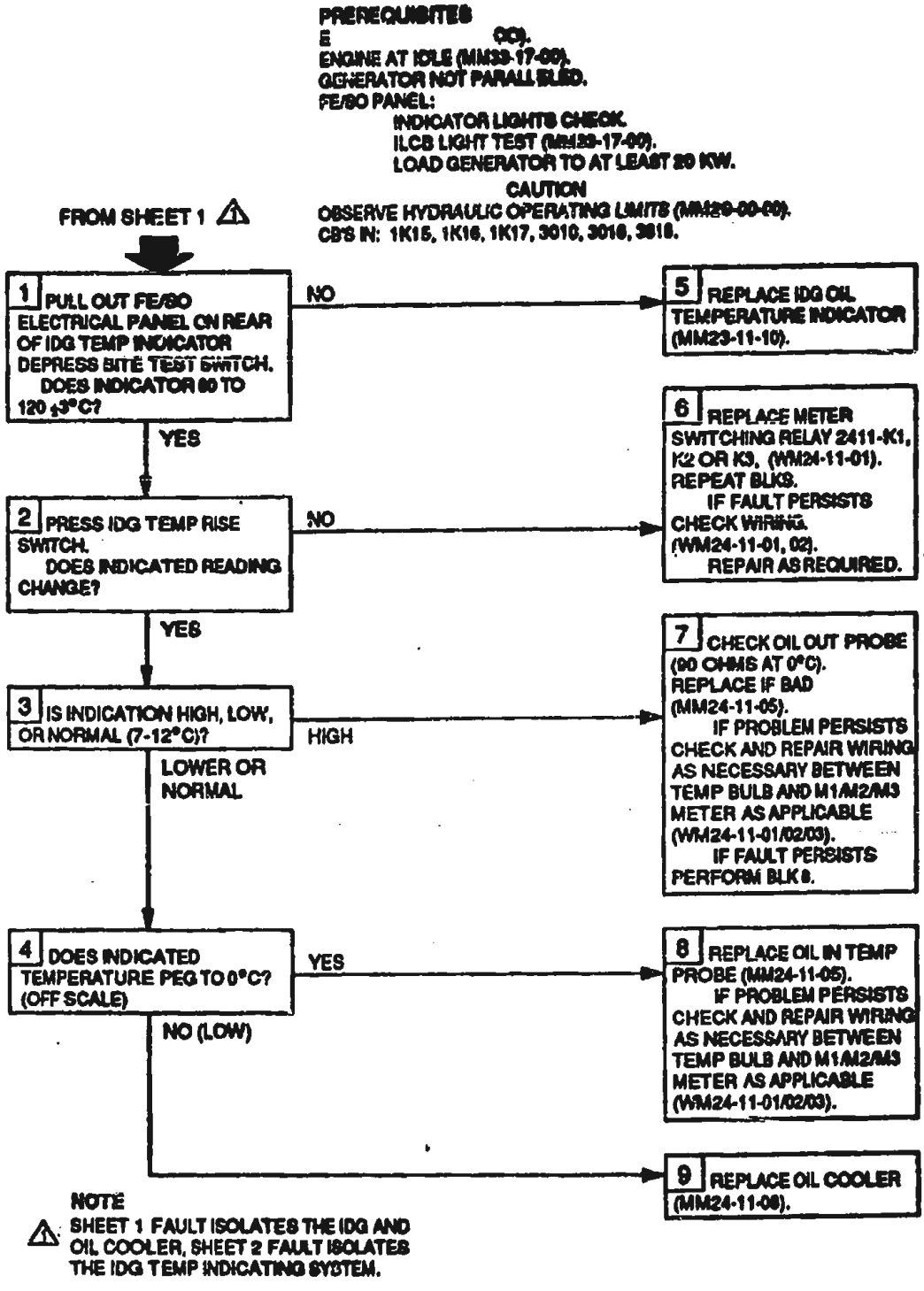

PREREQUISITES
E CO).
ENGINE AT IDLE (MM33-17-00).
GENERATOR NOT PARALLELED.
FE/SO PANEL:
INDICATOR LIGHTS CHECK.
ILCB LIGHT TEST (MM33-17-00).
LOAD GENERATOR TO AT LEAST 20 KW.
CAUTION
OBSERVE HYDRAULIC OPERATING LIMITS (MM29-00-00).
CB'S IN: 1K15, 1K16, 1K17, 3010, 3015, 3016.
IDG
OIL TEMPERATURE
FAULT INDICATION
(F. I.)
1 CAUTION
A RAPID RISE OR HIGH TEMPERATURE INDICATION MAY INDICATE INTERNAL DAMAGE. A VISUAL INSPECTION SHOULD BE MADE BEFORE PROCEEDING WITH FAULT ISOLATION (MM24-11-01, 601).
WITH ENGINE AT 51% N3 IS IDG OIL TEMPERATURE ABOVE 145°C OR 15°C HIGHER THAN OTHER IDG'S?
NO
5 IS IDG LOW PRESSURE LIGHT ON?
NO
8 SYSTEM NORMAL.
YES
6 CHECK IDG OIL LEVEL. IS IT OK? (MM24-11-01, 601).
NO
9 SERVICE AS REQUIRED (MM24-11-01, 301).
YES
7 REPLACE IDG (MM24-11-01, 401) AND CHECK CHARGE FILTER FOR SIGNS OF CONTAMINATION AND SCAVENGE FILTER FOR COLLAPSATION AND IN BYPASS. ARE FILTERS OK?
NO
10 REPLACE OIL COOLER (MM24-11-08).
YES
TO SHEET 2 ⚠
YES
2 CHECK IDG OIL LEVEL. IS IT OK? (MM24-11-01, 601).
NO
11 SERVICE AS REQUIRED (MM24-11-01, 301).
YES
3 REPLACE IDG (MM24-11-01, 401) AND CHECK CHARGE FILTER FOR SIGNS OF CONTAMINATION AND SCAVENGE FILTER FOR A COLLAPSATION OR IN BYPASS STATE. ARE FILTERS OK?
NO
12 REPLACE OIL COOLER (MM24-11-08).
YES
4 CHECK TEMPERATURE INDICATOR WITH THE ADJACENT IDG TEMPERATURE INDICATOR. IS THE TEMPERATURE INDICATOR OK?
NO
13 REPLACE IDG OIL TEMPERATURE INDICATOR (MM23-11-10).
YES
TO SHEET 2 ⚠
NOTE
⚠ SHEET 1 FAULT ISOLATES THE IDG AND OIL COOLER, SHEET 2 FAULT ISOLATES THE IDG TEMP INDICATOR SYSTEM.

M1-0002-24-328

R
R IDG Oil Temperature Fault Isolation
Figure 105 (Sheet 1)

EFFECTIVITY: ALL

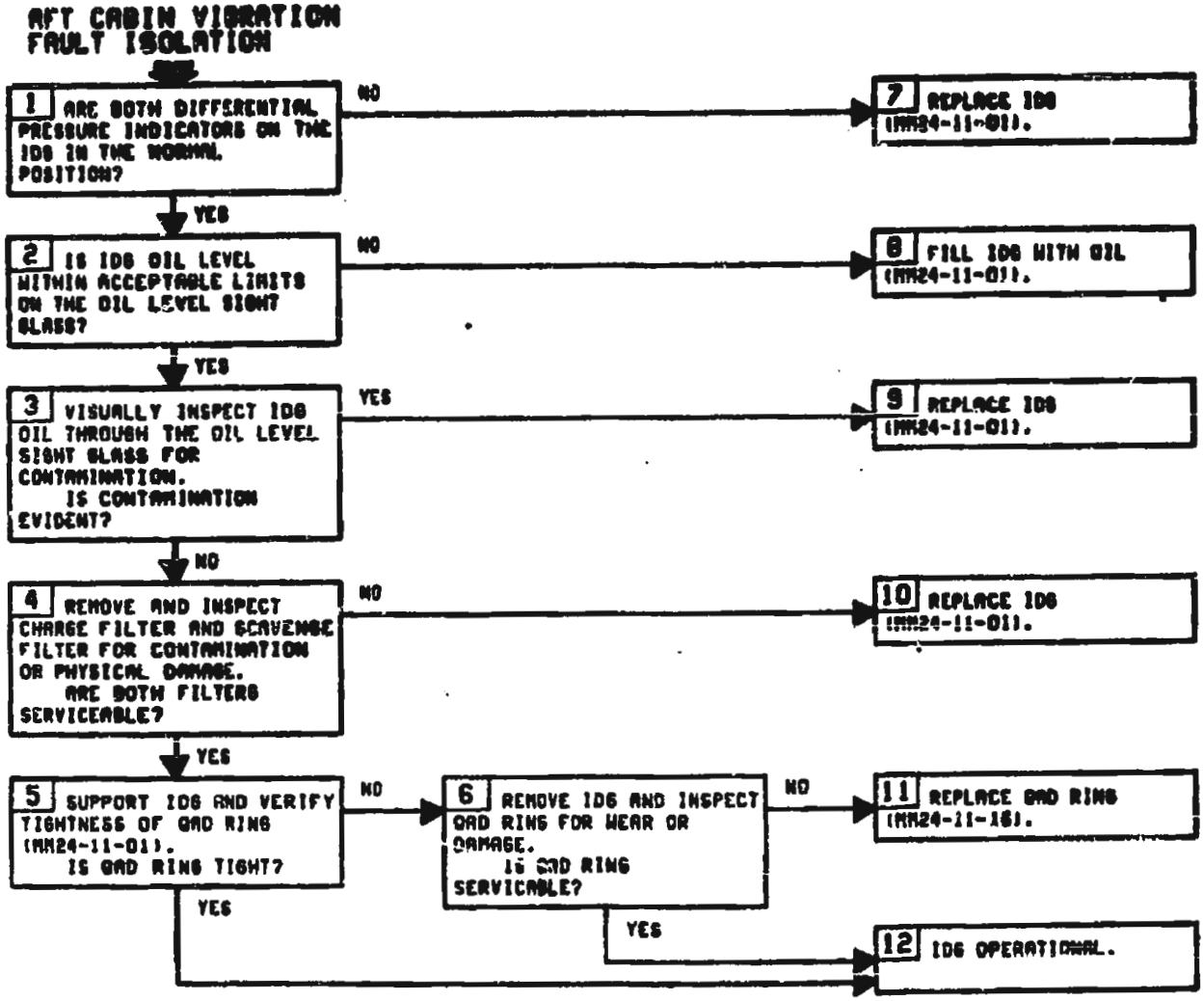
001B


PREREQUISITES
E
OC).
ENGINE AT IDLE (MM33-17-00).
GENERATOR NOT PARALLELED.
FE/SO PANEL:
INDICATOR LIGHTS CHECK.
ILCB LIGHT TEST (MM33-17-00).
LOAD GENERATOR TO AT LEAST 20 KW.
CAUTION
OBSERVE HYDRAULIC OPERATING LIMITS (MM20-00-00).
CB'S IN: 1K15, 1K16, 1K17, 3010, 3016, 3018.
FROM SHEET 1
1 PULL OUT FE/SO ELECTRICAL PANEL ON REAR OF IDG TEMP INDICATOR DEPRESS BITE TEST SWITCH. DOES INDICATOR GO TO 120 ±3°C?
NO
5 REPLACE IDG OIL TEMPERATURE INDICATOR (MM23-11-10).
YES
2 PRESS IDG TEMP RISE SWITCH. DOES INDICATED READING CHANGE?
NO
6 REPLACE METER SWITCHING RELAY 2411-K1, K2 OR K3, (MM24-11-01). REPEAT BLK3. IF FAULT PERSISTS CHECK WIRING (MM24-11-01, 02). REPAIR AS REQUIRED.
YES
3 IS INDICATION HIGH, LOW, OR NORMAL (7-12°C)?
HIGH
7 CHECK OIL OUT PROBE (90 OHMS AT 0°C). REPLACE IF BAD (MM24-11-05). IF PROBLEM PERSISTS CHECK AND REPAIR WIRING AS NECESSARY BETWEEN TEMP BULB AND M1/M2/M3 METER AS APPLICABLE (MM24-11-01/02/03). IF FAULT PERSISTS PERFORM BLK 8.
LOWER OR NORMAL
4 DOES INDICATED TEMPERATURE PEG TO 0°C? (OFF SCALE)
YES
8 REPLACE OIL IN TEMP PROBE (MM24-11-05). IF PROBLEM PERSISTS CHECK AND REPAIR WIRING AS NECESSARY BETWEEN TEMP BULB AND M1/M2/M3 METER AS APPLICABLE (MM24-11-01/02/03).
NO (LOW)
9 REPLACE OIL COOLER (MM24-11-08).
NOTE
SHEET 1 FAULT ISOLATES THE IDG AND OIL COOLER, SHEET 2 FAULT ISOLATES THE IDG TEMP INDICATING SYSTEM.

M1-0000-24-1428

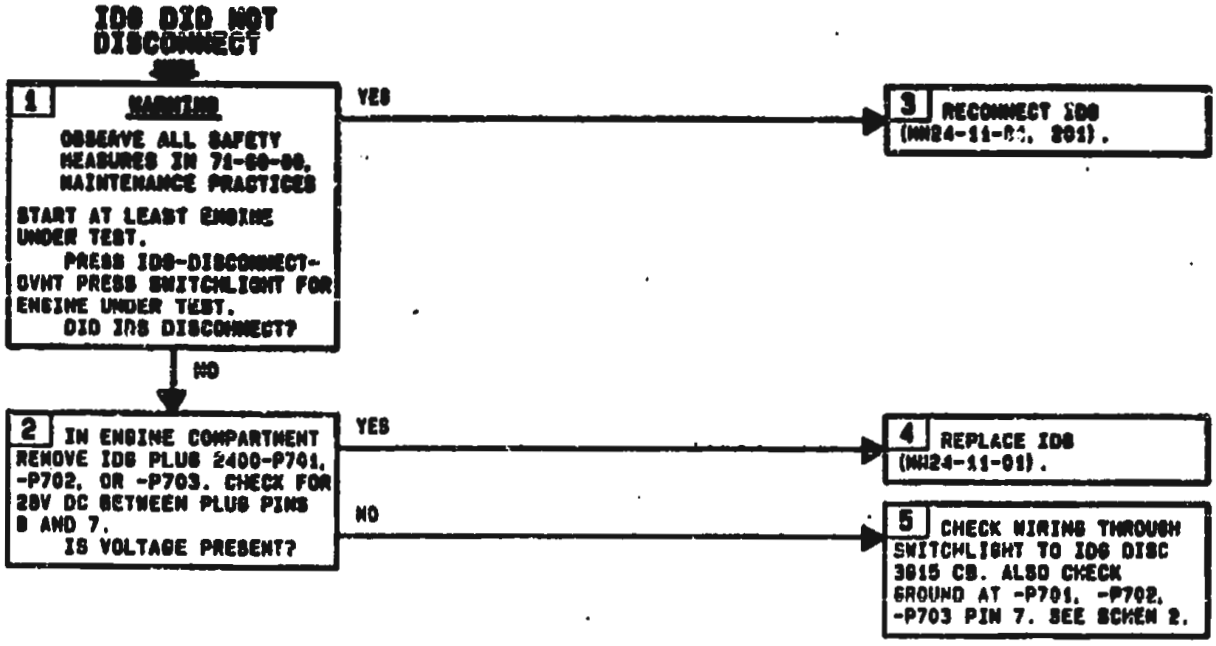
R IDG Oil Temperature Fault Isolation
R Figure 105 (Sheet 2)

PREREQUISITES
GENERATOR NO. 2 NOT OPERATING


AFT CABIN VIBRATION FAULT ISOLATION
1 ARE BOTH DIFFERENTIAL PRESSURE INDICATORS ON THE IDG IN THE NORMAL POSITION?
NO
7 REPLACE IDG (MM24-11-01).
YES
2 IS IDG OIL LEVEL WITHIN ACCEPTABLE LIMITS ON THE OIL LEVEL SIGHT GLASS?
NO
8 FILL IDG WITH OIL (MM24-11-01).
YES
3 VISUALLY INSPECT IDG OIL THROUGH THE OIL LEVEL SIGHT GLASS FOR CONTAMINATION. IS CONTAMINATION EVIDENT?
YES
9 REPLACE IDG (MM24-11-01).
NO
4 REMOVE AND INSPECT CHARGE FILTER AND SCAVENGE FILTER FOR CONTAMINATION OR PHYSICAL DAMAGE. ARE BOTH FILTERS SERVICEABLE?
NO
10 REPLACE IDG (MM24-11-01).
YES
5 SUPPORT IDG AND VERIFY TIGHTNESS OF OAD RING (MM24-11-01). IS OAD RING TIGHT?
NO
6 REMOVE IDG AND INSPECT OAD RING FOR WEAR OR DAMAGE. IS OAD RING SERVICABLE?
NO
11 REPLACE OAD RING (MM24-11-16).
YES
YES
12 IDG OPERATIONAL.

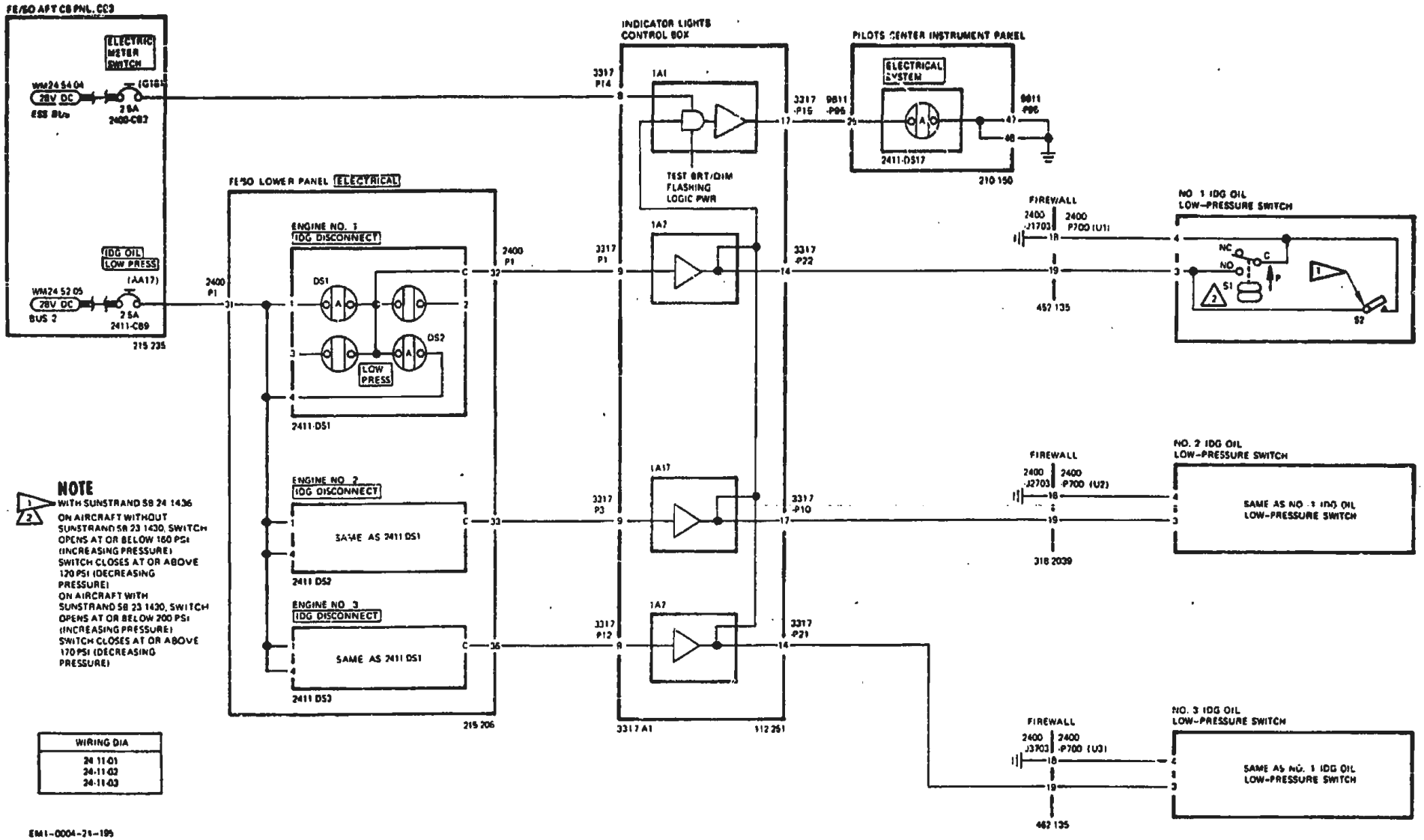
Aft Cabin Abnormal Vibration Fault Isolation
Figure 106

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
START ENGINE (MM71-00-00)
GENERATOR LOADED (NOT PARALLEL)
CB'S IN: 3015


IDG DID NOT DISCONNECT
1
WARNING
OBSERVE ALL SAFETY MEASURES IN 71-00-00, MAINTENANCE PRACTICES
START AT LEAST ENGINE UNDER TEST.
PRESS IDG-DISCONNECT-OVHT PRESS SWITCHLIGHT FOR ENGINE UNDER TEST.
DID IDG DISCONNECT?
YES
3
RECONNECT IDG (MM24-11-01, 201).
NO
2
IN ENGINE COMPARTMENT REMOVE IDG PLUG 2400-P701, -P702, OR -P703. CHECK FOR 28V DC BETWEEN PLUG PINS B AND 7.
IS VOLTAGE PRESENT?
YES
4
REPLACE IDG (MM24-11-01).
NO
5
CHECK WIRING THROUGH SWITCHLIGHT TO IDG DISC 3015 CB. ALSO CHECK GROUND AT -P701, -P702, -P703 PIN 7. SEE SCHEM 2.

NI-0000-24-1330

IDG Did Not Disconnect Fault Isolation
Figure 107



NOTE

1. WITH SUNSTRAND SB 24 1436 ON AIRCRAFT WITHOUT SUNSTRAND SB 23 1430, SWITCH OPENS AT OR BELOW 160 PSI (INCREASING PRESSURE) SWITCH CLOSES AT OR ABOVE 170 PSI (DECREASING PRESSURE)
2. ON AIRCRAFT WITH SUNSTRAND SB 23 1430, SWITCH OPENS AT OR BELOW 200 PSI (INCREASING PRESSURE) SWITCH CLOSES AT OR ABOVE 170 PSI (DECREASING PRESSURE)

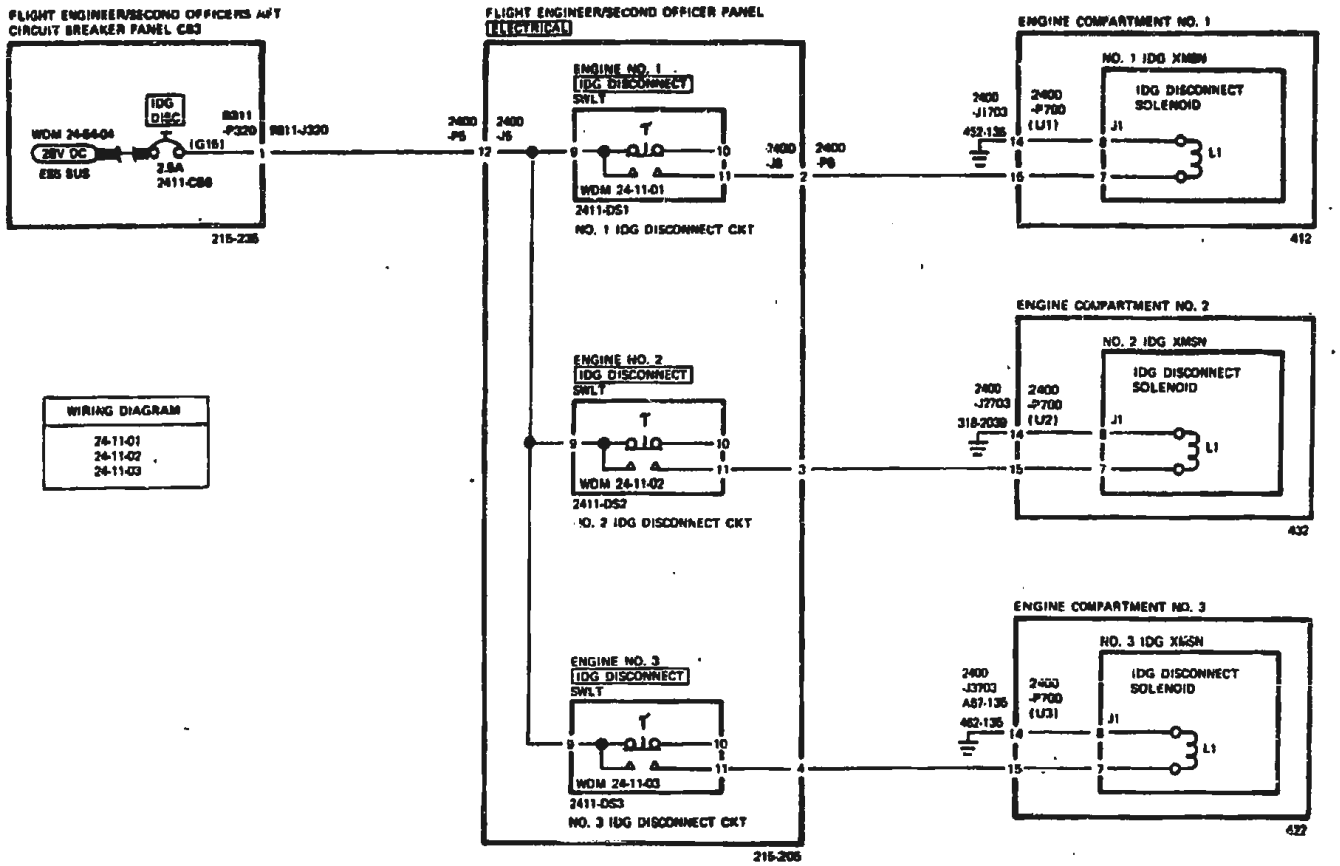
WIRING DIA
24-11-01
24-11-02
24-11-03

EM1-0004-24-195

R R IDG Low-Pressure Light Schematic
SCHEM 1

EFFECTIVITY: ALL

001B

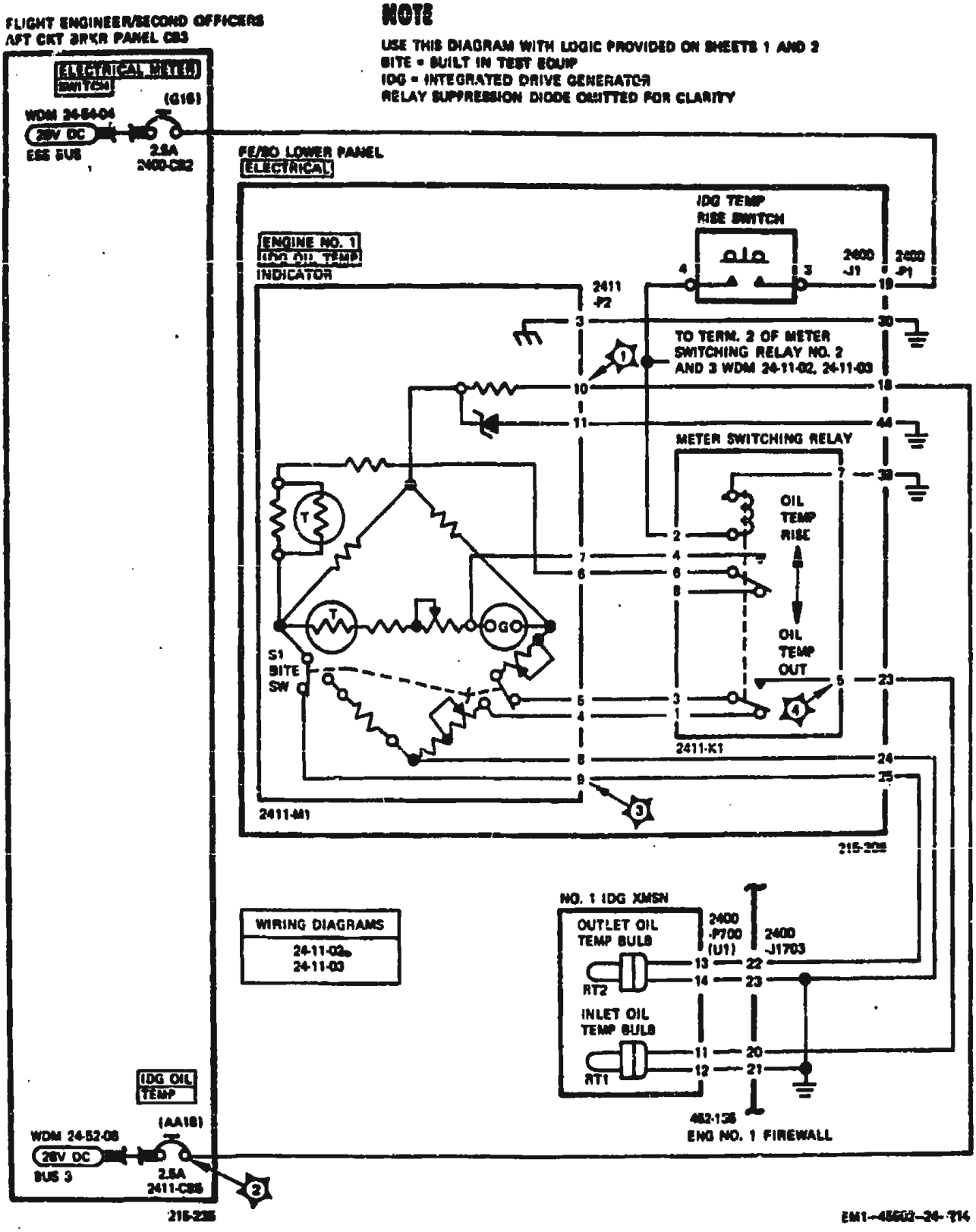


E401-0102-24-100

R IDG Disconnect Circuit Schematic
R SCHEM 2

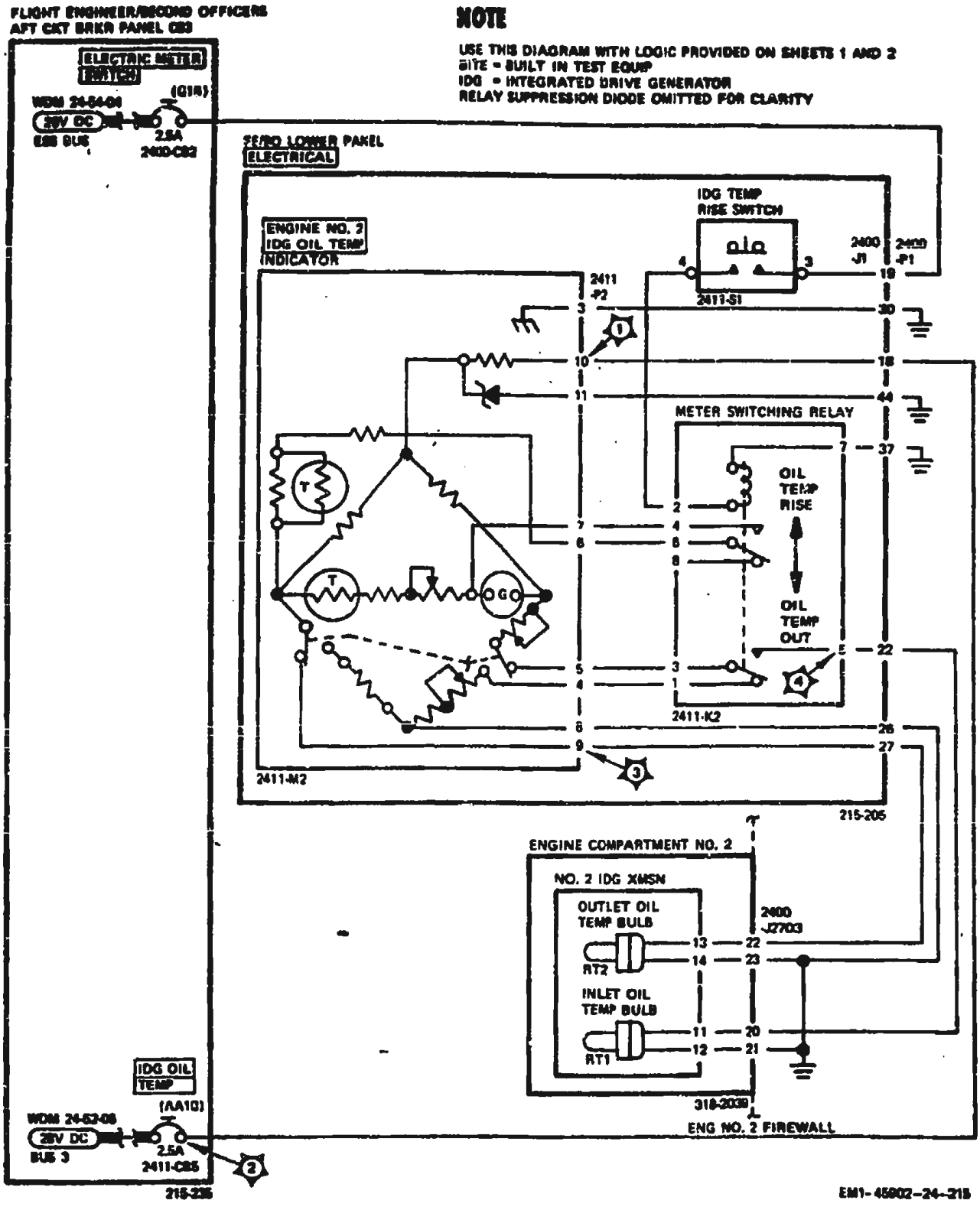
EFFECTIVITY: ALL

001B



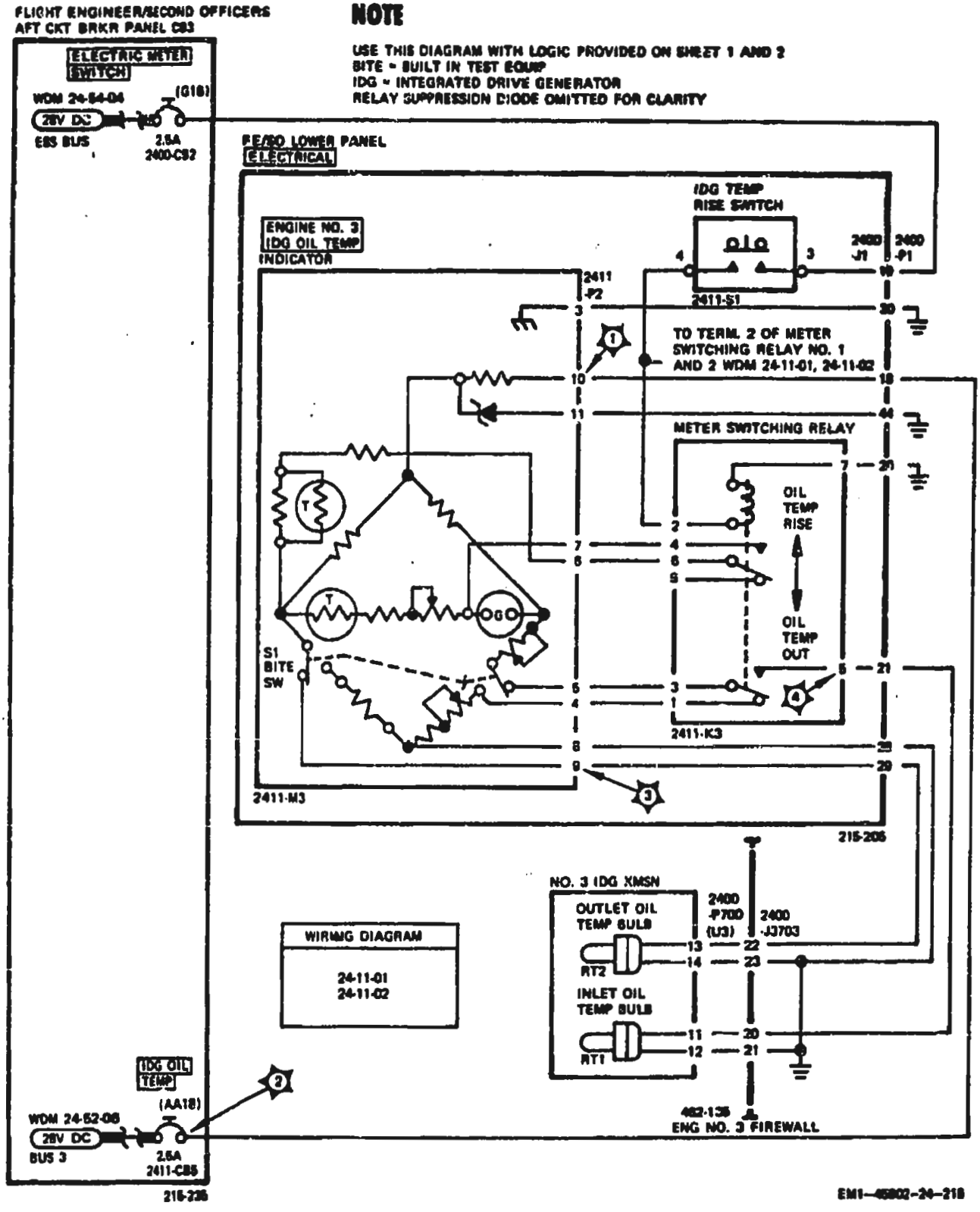
R IDG Oil Temperature Indicating System Schematic
R SCHEM 3 (Sheet 1)

EFFECTIVITY: ALL



R IDG Oil Temperature Indicating System Schematic
R SCHEM 3 (Sheet 2)

EFFECTIVITY: ALL



R IDG Oil Temperature Indicating System Schematic
R SCHEM 3 (Sheet 3)

IDG TRANSMISSION - MAINTENANCE PRACTICES

1. General

Under normal operating conditions, the IDG DISCONNECT - LOW PRESS switchlights on the FE/SO ELECTRICAL control panel, zone 215, are off. If, during operation, any one of the three switchlights come on or an IDG overheat condition becomes apparent (Ref. MM 24-11-00), the IDG must be disconnected immediately. Para. 2 describes the IDG disconnect procedure.

On aircraft 001-031 without SB24-082, if it is necessary to continue a flight with one IDG disconnected, the IDG oil level should be maintained in the green area on the oil level indicator plate for the installation position to a point between the top of the green band on the sight glass, and one-quarter inch above the top of the green band if possible to avoid unnecessary wear. If unavoidable the IDG is capable of 25 hours of operation in the disconnected mode without oil.

NOTE: There are three green bands on the IDG oil indicator plate: one each for the left, right, and center engines. Verify the IDG is filled to the proper green band.

On aircraft 001-031 with SB24-082 and 032-999, if it is necessary to continue a flight with the IDG disconnected, the IDG should be serviced to the normal oil fill level if possible, to avoid unnecessary wear. If unable to service, the IDG is capable of 25 hours of operation in the disconnected mode without oil.

NOTE: There are three black lines on the IDG low oil level indicator plate; one each for the left, right, and center engines. Service only if oil is below any of the black lines.

2. IDG Disconnect

A. Procedure

CAUTION: APPLICABLE ENGINE MUST BE RUNNING AT IDLE SPEED OR ABOVE BEFORE IDG DISCONNECT CAN BE FULLY ACCOMPLISHED.

DO NOT PRESS IDG DISCONNECT SWITCHLIGHT FOR PERIODS LONGER THAN 3 SECONDS. ALLOW A MINIMUM OF 60 SECONDS COOLING TIME BETWEEN ACTUATION PERIODS.

(1) With engine running at idle speed or above, momentarily press applicable IDG DISCONNECT switchlight on Flight Engineer/Second officers ELECTRICAL panel, zone 215.

(2) After disconnect, select applicable generator on ac meters selector switch, press PMG TEST switch, and verify that AC VOLTS meter indicates PMG OFF.

NOTE: The generator oil LOW PRESS light for the disconnected generator will come on and remain on.

(3) Install placard on ELECTRICAL panel to indicate inoperative IDG.

(4) Make appropriate entry in aircraft maintenance log.

CAUTION: DO NOT RECONNECT AN IDG THAT HAS BEEN DISCONNECTED FOR CAUSE. RECONNECT FOR PRIMING WHILE ADDING OIL IS NOT NECESSARY. THE IDG IS CAPABLE OF 25 HOURS OF OPERATION IN THE DISCONNECTED MODE WITHOUT OIL IN THE IDG. HOWEVER THIS WILL REDUCE THE SUBSEQUENT LIFE OF THE BEARING. FILLING WITH OIL WILL AVOID UNNECESSARY WEAR. USE STATIC OIL SUPPLY ONLY (NON-PRESSURE FILL). RECONNECTING CAN RESULT IN FURTHER DAMAGE. REMOVE AND REPLACE DISCONNECTED UNIT (REF. 24-11-01, 401).

CR NOTE: When an IDG is disconnected for illumination of
CR the "LOW PRESS" light or oil temperature
CR problem, remove the IDG filters and magnetic
CR chip detector. Inspect for metal contamination.
CR If clean - the IDG can be reserviced and
CR reconnected for leak checks and troubleshooting.

CAUTION: DO NOT RESET IDG DISCONNECT WITH ENGINE ROTATING. TO DO SO MAY RESULT IN DAMAGE TO IDG.

NOTE: The disconnect is reset by pulling the reset handle on the IDG. When properly reset, the indicator button in the reset handle remains in when depressed.

C 3. IDG Contamination

C A. General

C (1) If for any reason IDG oil is suspected to be
C contaminated with Hy-jet III of Skydrol, the following
C must be accomplished:

C NOTE: This check is applicable to Exxon 2380 oil.

C (a) Perform methyl alcohol check of IDG oil. (See paragraph B for procedure.)If results are negative, no further action is required.

C (b) If results are positive, perform methyl alcohol check on all IDG units on aircraft.

C (c) IDG's with positive indication of contamination must be drained, filters flushed, and IDG reserviced with clean oil. Run engine at idle 3 to 5 minutes; shut down engine, drain oil, replace filters, and reservice IDG with clean oil.

C (d) IDG's will be considered serviceable if all indications during run-up are normal.

C B. Methyl Alcohol Check

C (1) Equipment required - any small clear glass container, test tube, etc., quantity of methyl alcohol or methanol and sample of suspect oil (this type alcohol can usually be obtained from a drug store).

C (2) Mix three parts of methyl alcohol or methanol to one part of the suspect oil and shake vigorously.

C (3) If oil is not contaminated, mixture will remain clear after shaking. If contaminated with Hy-jet III or Skydrol, mixture will be cloudy and will remain so.

C (4) If oil contains water or moisture, the mixture will appear cloudy at first, but the oil will then settle to the bottom and alcohol will rise and remain cloudy. This stratification may take five to ten minutes.

C C. Log Book Handling

C (1) A log book entry as to which IDG's were contaminated and flushed or changed must be made. MCIMD and MCIEE must also be notified by message for follow up action.

C D. Dispatch Requirements

C (1) No more than one IDG may be continued in service that was found contaminated and flushed per paragraph 1, (a), (b), (c) and (d).

C (2) Contact MCIMD/MCIEE for further evaluation.

C 4. IDG Operation in Disconnect Mode

C A. If it is necessary to continue a flight with one IDG disconnected, the IDG oil level should be maintained at a point between the top of the green band on the sight glass, and one quarter inch above the top of the green band.

C NOTE: There are three green bands on the IDG oil indicator plate: one each for the left, right, and center engines. Verify the IDG is filled to the proper green band.

C 5. Policy - Verification of IDG Disconnect and Reconnection

C A. General

C When it becomes necessary to disconnect a IDG, it is imperative to verify that a disconnect has actually occurred. Failure of a IDG to disconnect may be due to contamination in the disconnect plunger area within the IDG. A non-disconnected IDG when driven by the engine in an underspeed condition will not register on the voltmeter and frequency indicators.

C CAUTION: OPERATION OF A MALFUNCTIONING IDG THAT HAS NOT DISCONNECTED CAN RESULT IN EXTENSIVE DAMAGE TO THE IDG.

C B. Disconnect of IDG in Flight

C (1) When a disconnect is made in flight due to an electrical or IDG malfunction the crew can verify disconnect (1) by the low oil pressure light coming on; and (2) oil temperature cooling after disconnect switch is actuated. IDG disconnect to also be verified by loss of PMG.

C C. Maintenance Action Required

C (1) If an inflight disconnect has been made and the aircraft is on a through flight or quick turn and the intent is to dispatch with the IDG in the disconnected mode per the MEL the only maintenance action required is to assure the IDG oil is serviced to full.

C D. Checks Made Prior to Reconnect of a IDG

C (1) If maintenance decides to reconnect the IDG to perform troubleshooting; the following action must be accomplished prior to operating the IDG:

C (a) Remove and check chip detector for metal.

C (b) Remove and check scavenge oil filter for metal. Check oil level.

C E. Verification of IDG Disconnect After IDG is Reconnected

C (1) After a reconnect and the decision is made to redisconnect the IDG, the disconnect must be made with the engine running and verified by the low oil pressure light, or MPG as outlined in Paragraph 5B above.

C 6. IDG Oil System Leak Tester (Tool No. 24-11-03-0664) - For Static Leak Check

C A. General

C (1) A tester has been provided which simplifies leak checking of IDG oil systems. It enables performing the checks pneumatically, rather than by operating engines to pressurize those oil systems. As illustrated, the tool consists simply of a regulator, shutoff valve and necessary fittings for adapting to a pneumatic source and the IDG. The procedures for using this tester are as follows, and it is emphasized that this job sequence must be followed as given.

C B. Preparation (Refer Figure 201)

C (1) Insure that the tester's shut-off valve is in the CLOSED position and that the regulator handle is adjusted to the CLOSED position.

C (2) Connect the tester to a pneumatic source (building air supply or nitrogen source regulated to no more than 100 psi).

C (3) Turn shut-off valve to the OPEN position. Adjust the regulator to 20 - 25 psi (maximum) output pressure.

C (4) Close shut-off valve and connect the tester's hose fittings to the IDG oil servicing fitting.

C (5) Open shut-off valve. Readjust regulator to 20 - 25 psi (maximum output pressure).

C C. Test

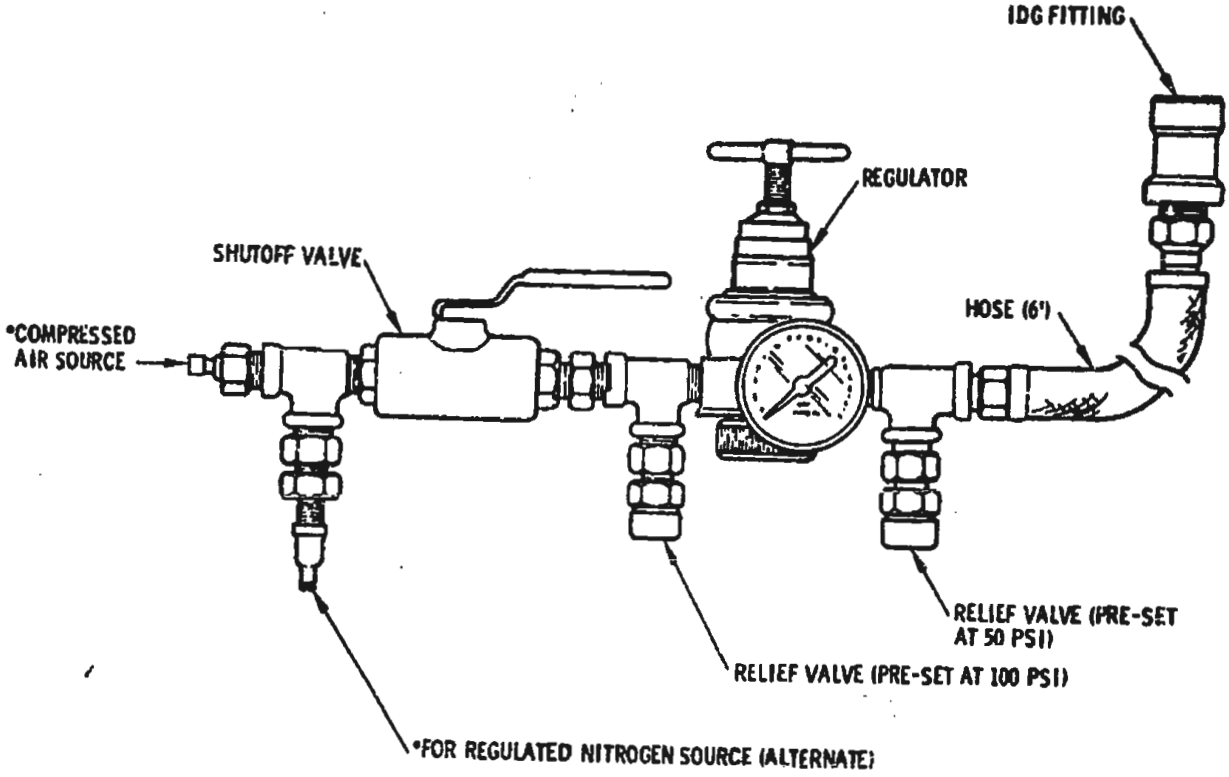
C (1) Turn shut-off valve to CLOSED position.

C C (2) If the IDG oil system has no leakage, the tester's gauge pressure will remain stable.

C C C (3) Turn shut-off valve to the OPEN position and visually check the entire system for leaks, using soap suds or equivalent leak detector fluid.

C C (4) Turn shut-off valve to the CLOSED position and make appropriate corrections to the IDG oil system.

C C (5) Adjust regulator to the CLOSED position. Remove the tester (TW Control No. 473-548ML-005).



*IF A REGULATED NITROGEN SOURCE IS TO BE USED, THE COMPRESSED AIR SOURCE PORT MUST BE PLUGGED.

M1-0000-24-1245

CR CR Leak Tester - IDG Oil System (Tool No. 24-11-03-0664A)
Figure 201

INTEGRATED DRIVE GENERATOR (IDG) ASSEMBLY - SERVICING

1. Equipment and Materials

Container (10 quarts, minimum)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Lubricant, Acryloid, HF825, Rohm and Haas, or equivalent

O-rings (Ref. Fig. 301)

2. Referenced Procedures

12-12-21	IDG Oil Replenishing
71-11-00	Cowling Engines No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 Cowling - General Servicing

3. Servicing

A. Draining Oil System

(1) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

(2) On aircraft without SB24-082, position container under IDG and do the following to drain oil (Ref. Fig. 301).

(a) Vent IDG by slowly loosening and removing gravity fill plug.

(b) Remove reservoir drain plug (RSVR DR).

CAUTION: DO NOT PRY ON DUAL CAP ASSEMBLY. THE RIGHT HAND CAP IS A LOCK/UNLOCK ASSEMBLY WHICH CAN BE REMOVED OR INSTALLED BY PULLING OR PUSHING BY HAND. THE LEFT HAND CAP HAS A SNAP ACTION.

(2) On aircraft with SB24-082, position container under IDG and do the following to drain oil (Ref. Fig. 301).

WARNING: PUSHING THE VENT RELIEF VALVE MAY CAUSE SOME OIL TO SPRAY OUT OF VENT. AFTER PUSHING THE PRESSURE RELIEF VALVE, PERSONNEL SHOULD STAND BACK A SAFE DISTANCE.

(a) Push vent relief valve to relieve internal pressure and stand clear after pushing vent relief valve.

(b) Remove dual cap assembly from pressure fill and standpipe fittings.

NOTE: On aircraft with SB24-108, there will be an oil diverter valve installed in the standpipe fitting. The oil diverter valve should extend far enough out to expose the oil diverting ports.

(c) Remove reservoir drain plug (RSVR DR).

R (3) To ref-fit caps (Ref. Fig. 302)

R (a) Hold both caps, located over the connections and R push on.

R (b) Push the outer sleeve towards the IDG to allow the R balls to "click" into the groove.

R (c) Release the sleeve and it should spring back to R its center locking position.

R (d) The end of the sleeve should now be flush with the R fixed inner part.

R (e) Pull on the plate to check that the assembly is R locked.

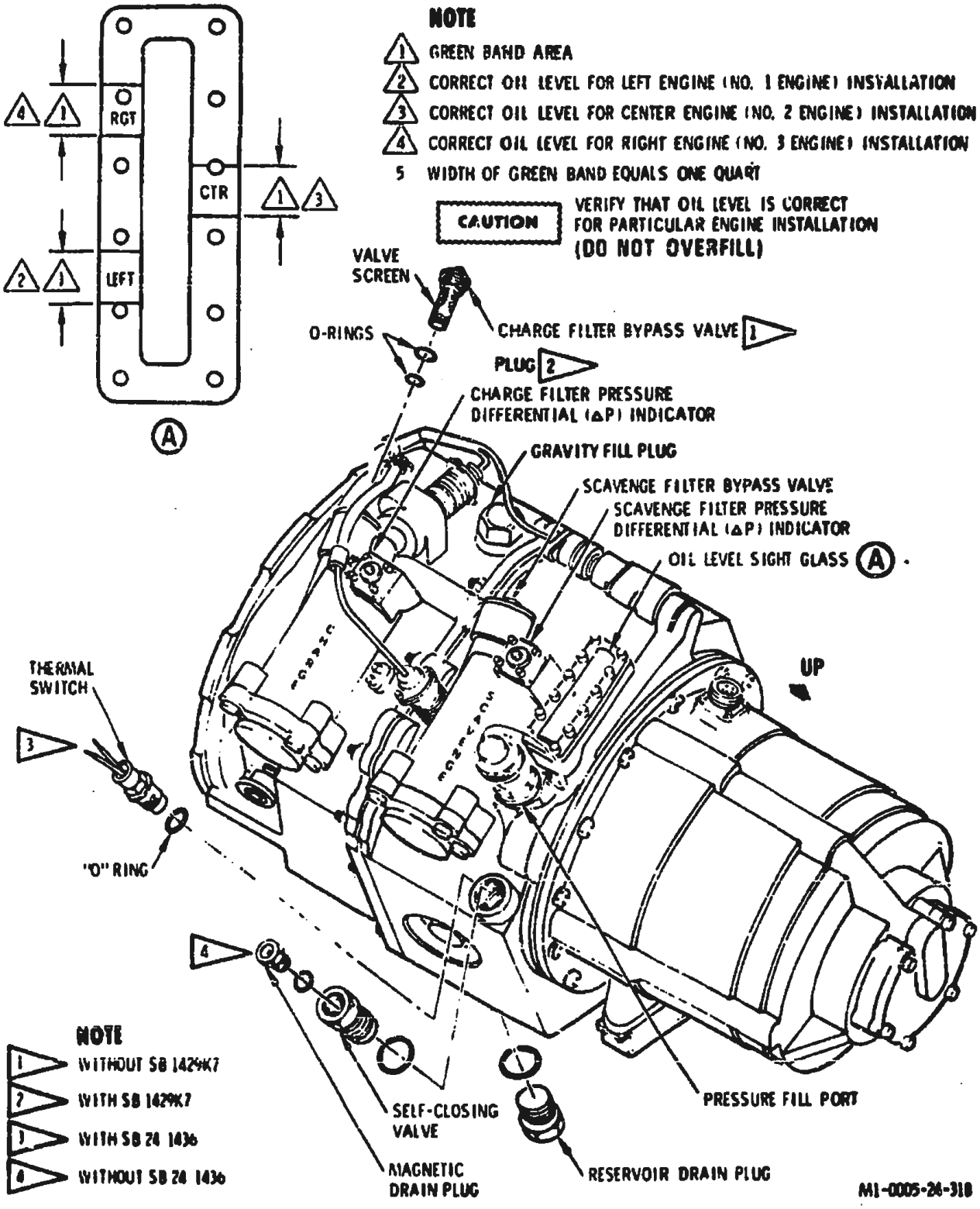
R CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT R TO INSTALL IDG O-RINGS.

R (4) Reinstall IDG parts using applicable torque values specified in Table 301. Reinstall parts using new lubricated O-rings.

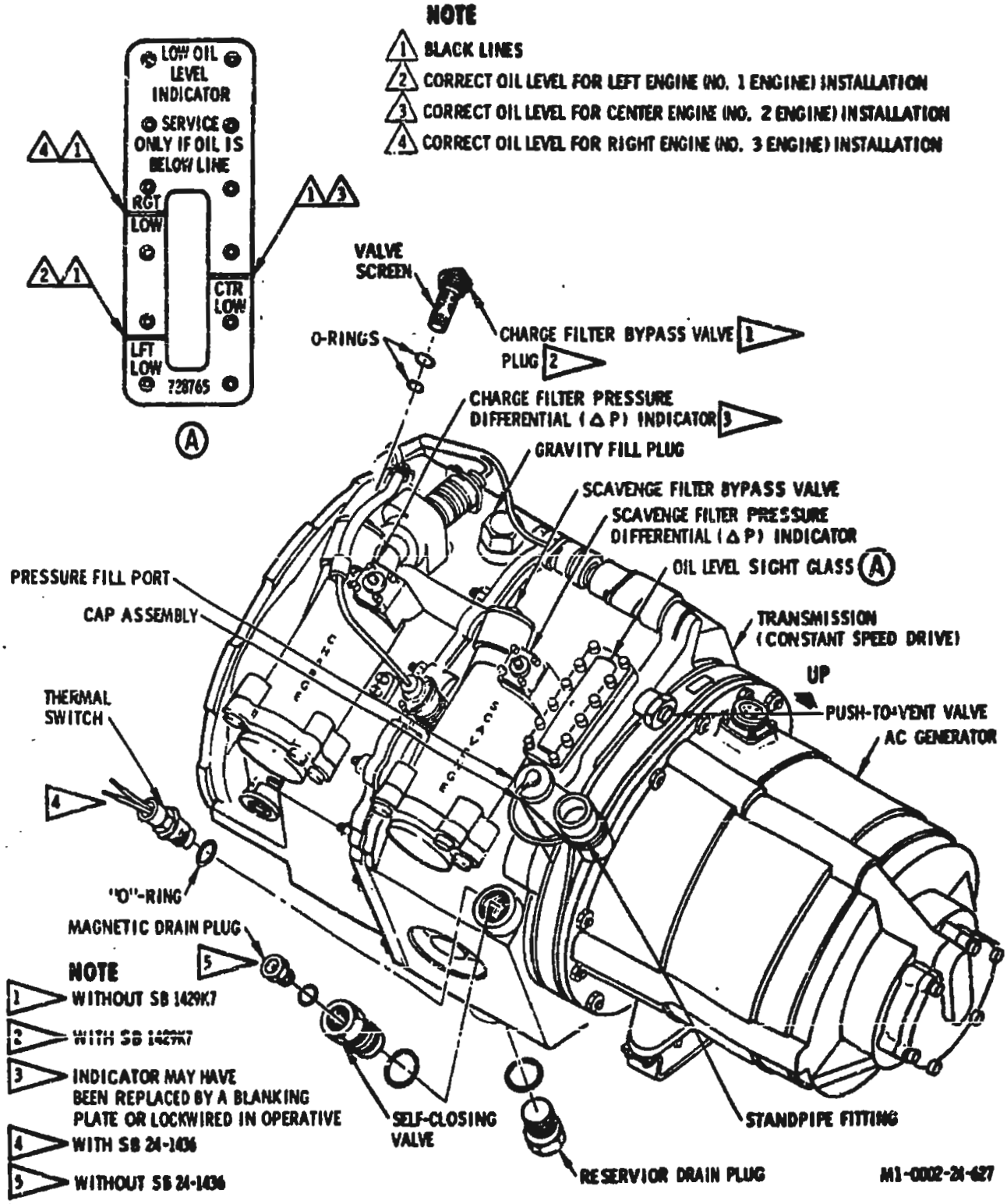
R (5) Lock-wire IDG parts after torquing.

R (6) Fill oil system (Ref. 12-12-21).

NOTE: On aircraft with Sundstrand Service Bulletin 24-1413 accomplished oil will not be changed on the aircraft.



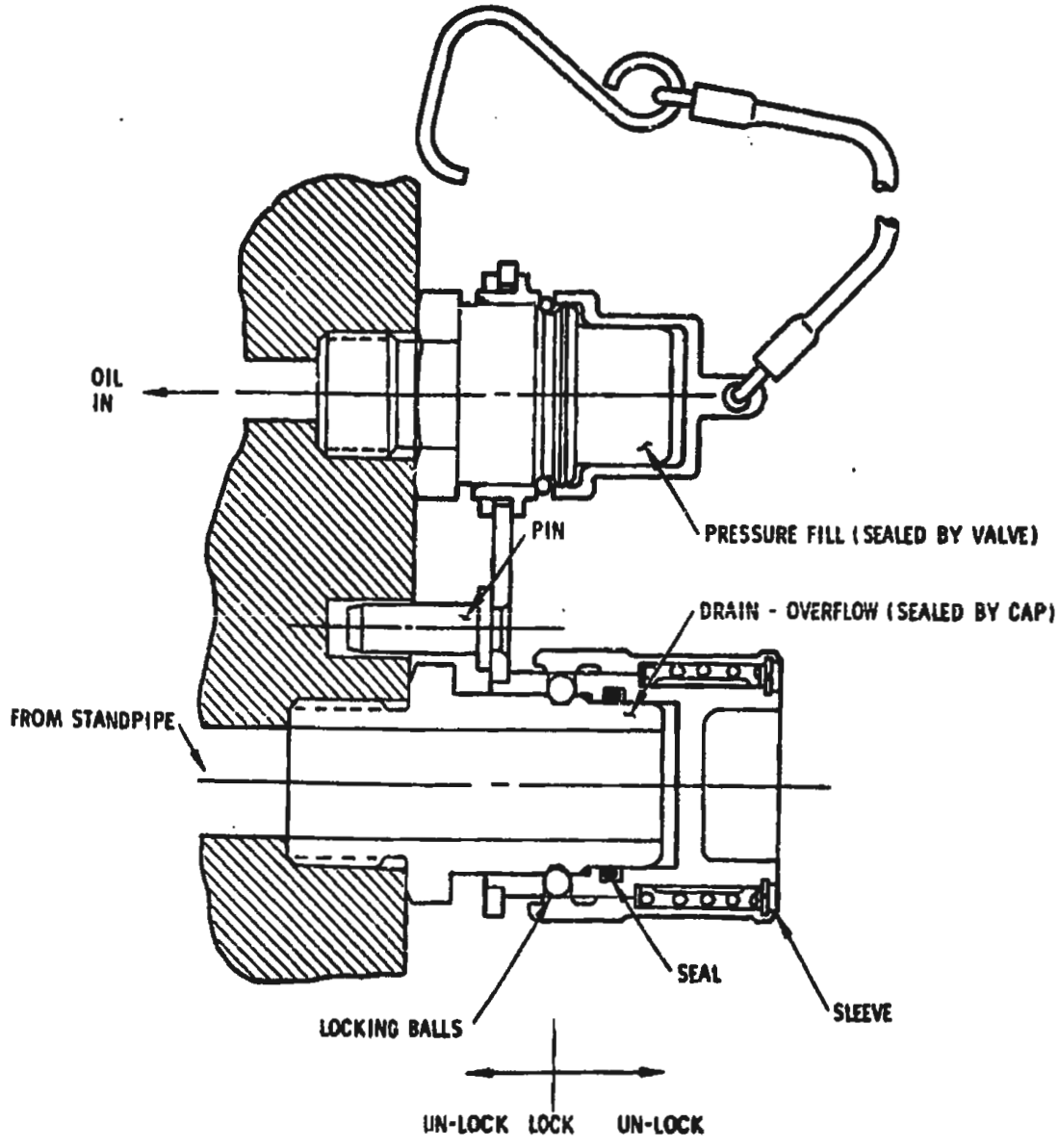
Servicing Points on IDG
Figure 301



R
R

Servicing Points on IDG
Figure 301

EFFECTIVITY: WITH SB24-082



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R
R Dual Cap-Drain/Pressure Fill Fitting
Figure 302

R EFFECTIVITY: ALL
R
001B

Reinstallation of IDG Parts
Table 301

PART	TORQUE (LB IN.)
Self-closing valve	30 to 40
Magnetic plug	15 to 20
Reservoir drain plug (RSVR DR)	40 to 55

R (7) Close and secure engine cowl panels.

INTEGRATED DRIVE GENERATOR (IDG) ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

IDG Handling Adapter, PN B896, or equivalent

T2 Transmission Jack, Blackhawk Company, (Part of BG88) or equivalent

Spanner Wrench, Rolls-Royce, PN UT818, or equivalent

Oil (8.5 quarts), Sundstrand Spec MS 02.40, or equivalent

O-rings (Ref. Fig. 401)

Lubricant, Acryloid, Rohm and Haas, HF825, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Container (10 quarts, minimum)

Solvent, Fed Spec P-D-680, or equivalent

2. Referenced Procedures

	6-40-00	Exterior Access Doors and Panels - Powerplant and Pylon
	12-12-21	Integrated Drive Generator (IDG) Oil Replenishing
	24-11-01	IDG Assembly - Adjustment and Test
	24-11-01	IDG Assembly - Inspection and Check
	24-11-01	IDG Oil Low-pressure Light Fault Isolation - Figure 102
	24-11-08	Oil Cooler - Removal and Installation
	24-11-16	QUICK ATTACH-DETACH ADAPTER KIT - Removal and Installation
R R	24-11-19	Integrated Drive Generator (I.D.G.) Cables - Removal and Installation
	24-21-05	Generator Control Unit - Removal and Installation
	71-00-00	Power Plant - Adjustment and Test

3. Removal/Installation

A. Removal

CAUTION: THE IDG MUST BE REMOVED AS A COMPLETE ASSEMBLY ONLY. COMPONENT PARTS FOR WHICH THERE ARE NO REMOVAL AND INSTALLATION PROCEDURES PROVIDED IN THIS MAINTENANCE MANUAL MUST NOT BE REMOVED EXCEPT AS PART OF THE COMPLETE IDG ASSEMBLY. FAILURE TO COMPLY WITH THIS DIRECTION CAN RESULT IN CATASTROPHIC FAILURE OF IDG AND CONTAMINATION OF THE OIL COOLER.

(1) Open cowl panels for engine No. 1, No. 2, or No. 3 (Ref. 6-40-00).

(2) Disconnect main generator leads.

NOTE: Do not remove cable clamp near end of leads.

(3) Disconnect wiring harnesses from generator connectors and from IDG transmission main connector.

(4) On aircraft without SB24-082, loosen gravity fill plug to relieve pressure (Ref. Fig. 401).

(4) On aircraft with SB24-082, press push-to-vent valve to relieve pressure (Ref. Fig. 401).

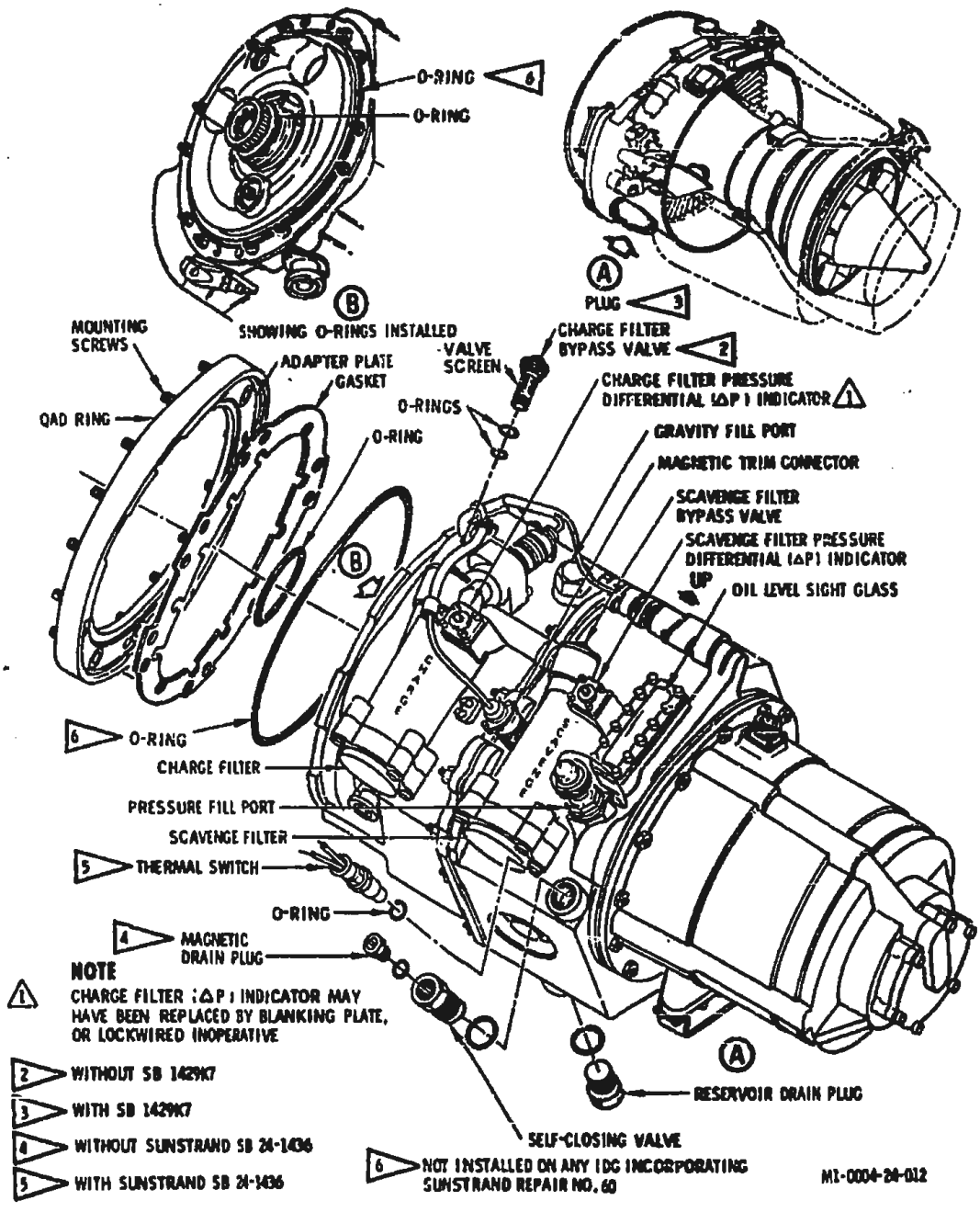
CAUTION: USE EXTREME CARE WHEN WORKING ON IDG TRANSMISSION OIL SYSTEM TO KEEP THE SYSTEM CLEAN.

(5) On aircraft without SB24-082, remove reservoir drain plug (RSVR DR), magnetic plug, and self-closing valve assembly.

(5) On aircraft with SB24-082, remove cap assembly, magnetic plug, and self-closing valve assembly, and reservoir drain plug (RSVR DR). Drain oil into a container.

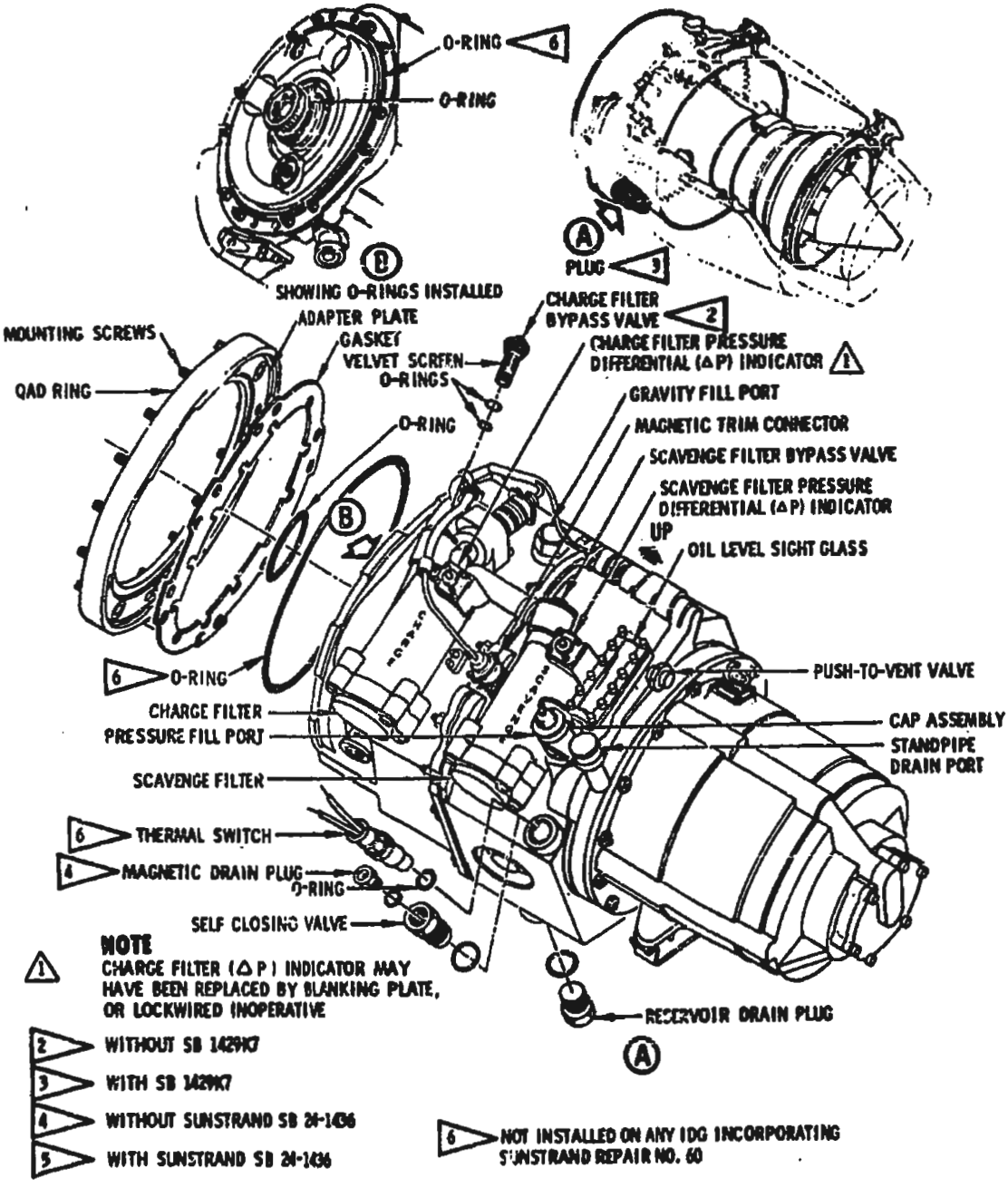
R NOTE: On aircraft with SB24-108,
R there will be an oil diverter valve installed in
R the standpipe fitting. The oil diverter valve
R should extend far enough out to expose the oil
R diverting ports.

(6) Replace plugs finger-tight; replace cap assembly.



R IDG Assembly - Removal and Installation
R Figure 401

EFFECTIVITY: WITHOUT SB24-082



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R IDG Assembly - Removal and Installation
R Figure 401

EFFECTIVITY: WITH SB24-082

001B

CAUTION: DAMAGE TO IDG CAN RESULT FROM CLEANING OIL COOLER WHILE INSTALLED ON AIRCRAFT. OIL COOLER MUST BE REMOVED AND CLEANED IN SHOP WHENEVER CLEANING IS REQUIRED.

DO NOT ALLOW IDG TO HANG ON INPUT SHAFT DURING REMOVAL. FAILURE TO SUPPORT IDG PROPERLY OR BUMPING SHAFT CAN DAMAGE PRECISELY FITTED MEMBERS OF THE INPUT SHAFT. WHEN REMOVING IDG, DO NOT HAMMER ON QAD TENSION BOLT TO LOOSEN QAD RING. HOUSINGS HAVE BEEN CRACKED WHEN TENSION BOLT HAS BEEN FORCED INTO BRACKET.

(a) The oil cooler may be contaminated if charge filter metallic or non-metallic contamination is visible or scavenge filter physical damage (pressure collapse, heat damage) is evident. The oil cooler must be removed and replaced (Ref. 24-11-08), oil lines thoroughly flushed with clean oil. Small amounts of non-metallic contamination in the scavenge filter are acceptable if there is no physical damage.

NOTE: On IDG's with Sunstrand Bulletin SB24-1413, the charge and scavenge filter bypass valves are deactivated.

(7) Using spanner wrench, disconnect oil-in and oil-out lines, and cap openings.

(8) Support IDG with IDG handling adapter and transmission jack to ensure that its weight is not being held by quick attach-detach (QAD) adapter.

NOTE: The handling adapter is attached to transmission jack with square lugs through base plate.

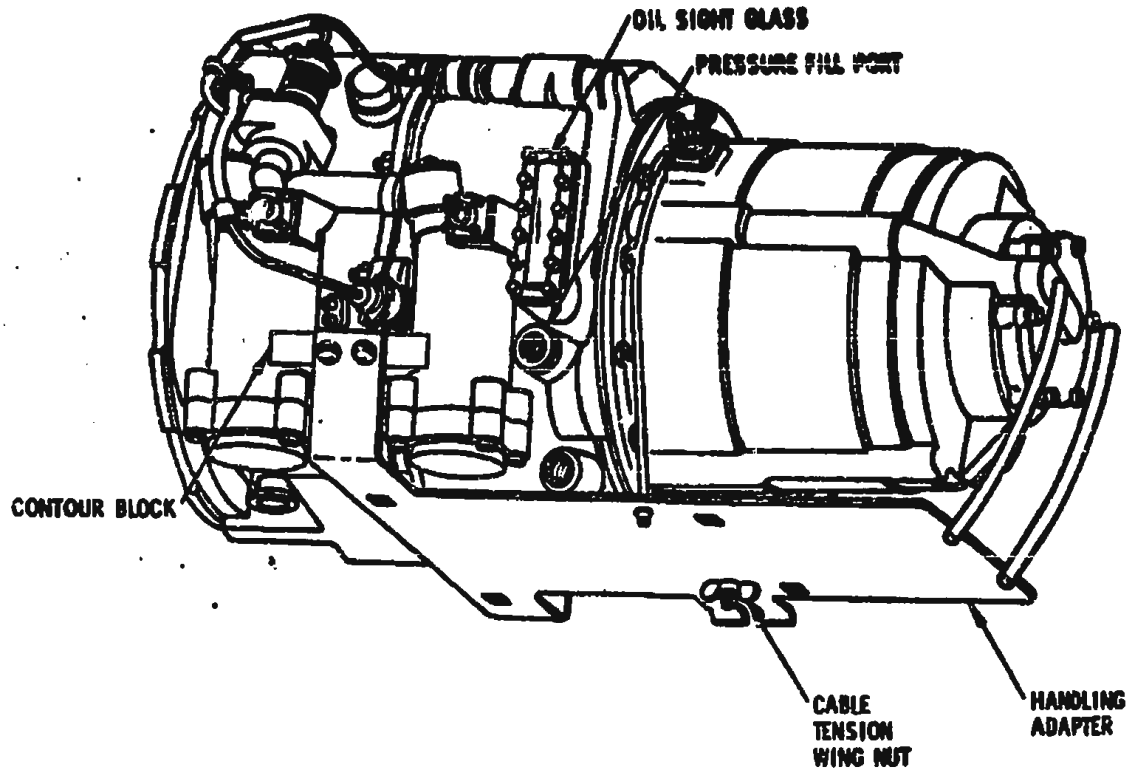
(9) Position adapter against bottom of IDG with contoured block between filter cases (Ref. Fig. 402). Adjust clamp to hold IDG firmly against block.

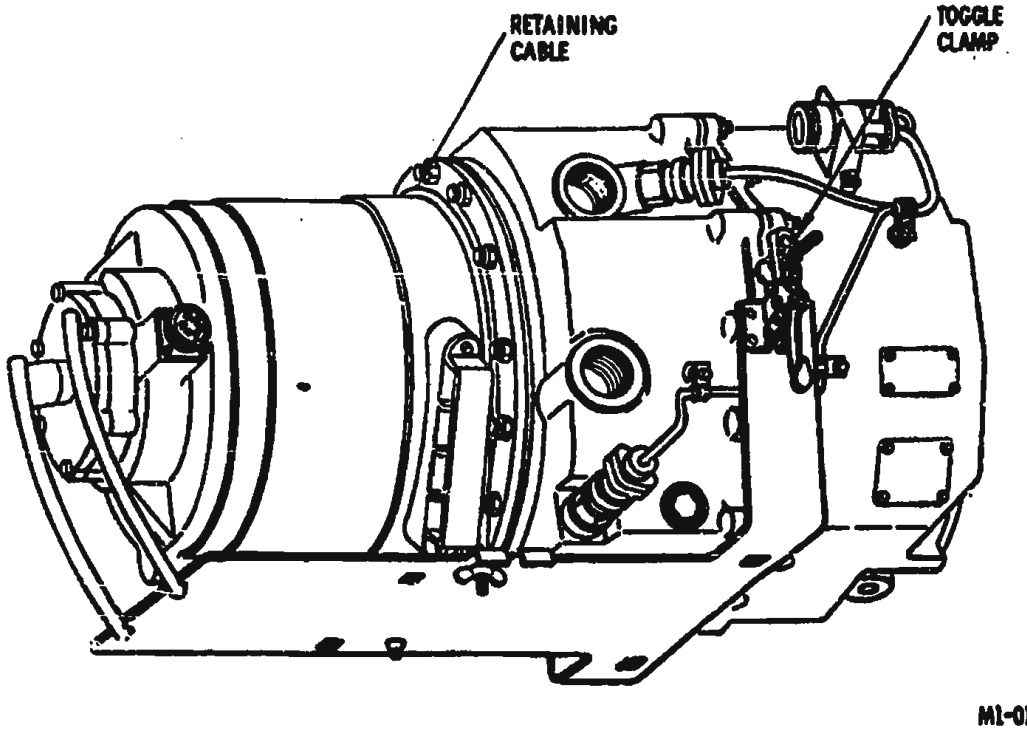
(10) Install holddown cable around forward end of generator and tighten snugly.

(11) Remove QAD ring tension bolt.

(12) Use soft-faced mallet or soft metal drive punch on QAD ring lug to rotate ring counterclockwise.

Alternate Method:





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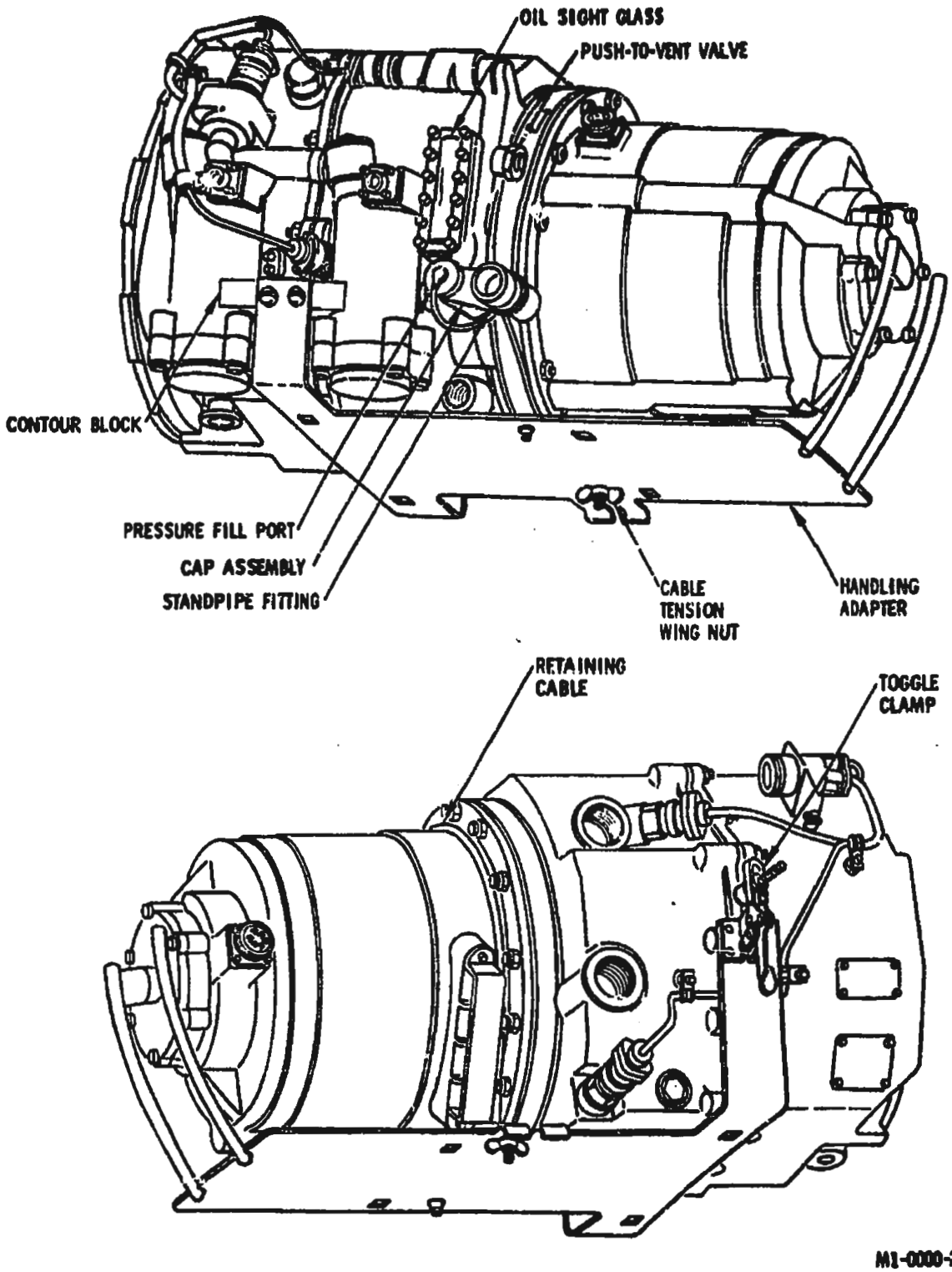
IDG Handling Adapter
Figure 402



IDG Handling Adapter
Figure 402

(a) Reinstall tension bolt through barrel nut from top.

(b) Place a piece of flat 1/4 inch steel bar stock or equivalent over hole in IDG bracket.

(c) Screw tension bolt down against bar stock to force QAD ring to rotate counterclockwise.

CAUTION: IF QAD RING CONTINUES TO DRAG AFTER INITIAL LOOSENING, CHECK ADJUSTMENT OF IDG SUPPORT TO ENSURE IDG WEIGHT IS PROPERLY SUPPORTED. DO NOT ALLOW IDG TO HANG ON INPUT SHAFT DURING REMOVAL.

(13) Rotate QAD ring until ring lugs align with notches in IDG mounting flange, and then move IDG aft away from engine pad.

R (14) On any IDG without Sunstrand repair No. 60,
R remove and discard O-rings from grooves in IDG face and
R input shaft.

R (14) On any IDG with Sunstrand repair No. 60,
R remove and discard O-ring from groove in IDG input
R shaft.

(15) Install shipping covers and plugs on IDG.

NOTE: Use shipping caps and plugs from replacement IDG.

B. Installation

(1) Inspect IDG for damage from handling and shipping.

NOTE: Do not remove shipping covers or plugs until aircraft fittings are to be installed.

(2) Inspect QAD ring for scars, cracks, and freedom of rotation and adapter plate for wear.

C (a) Check threads of QAD adapter, QAD ring and tension
C bolt for damage.

C (b) Check the underside of the QAD Lugs (i.e. the lugs
C that grasp the IDG flange) for wear steps and
C smooth surface.

C (c) Clean and lubricate all threads, self centering
C washer, lugs of QAD ring and the IDG flange with
C approved jet oil.

C NOTE: If anti-fretting compound is not available, to preclude a flight delay, a light coat of oil may be used for this purpose. Inspect threads of tension bolt for damage. Clean and lubricate the locking bolt and the self adjusting washer on the IDG and nut on locking bolt lug with approved IDG oil.

C WARNING: DO NOT GREASE INPUT SPLINE. GREASE OR ANTIFRETTING COMPOUND USED DURING TESTING IS NOT COMPATIBLE WITH ENGINE OIL AND CAN HARDEN OR CAKE.

(3) Apply a light coat of oil to threads of tension bolt and to self-adjusting barrel nut in QAD ring.

C (4) Remove all grease or antifretting compound from input spline using solvent.

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL O-RINGS.

VERIFY THAT O-RINGS ARE NOT STRETCHED OR DAMAGED DURING UNPACKAGING OR INSTALLATION.

C NOTE: In the event IDG QAD ring appears to bottom out or has less than 3/16 inch gap between clamp lug, use two gaskets Mfg. P/N 693206 between IDG ring and engine QAD ring.

R CAUTION: ON ANY IDG WITHOUT SUNSTRAND REPAIR NO. 60, VERIFY THAT O-RINGS ARE CORRECTLY INSTALLED IN GROOVES ON GENERATOR SHAFT AND ON IDG FACE (REF. DETAIL B, FIG. 401).

C (a) On any IDG without Sunstrand repair No. 60, install lubricated O-rings in grooves on IDG face and on input shaft (Ref. Fig. 401). Install gasket on IDG mounting flange.

R CAUTION: ON ANY IDG WITH SUNSTRAND REPAIR NO. 60, VERIFY THAT O-RING IS CORRECTLY INSTALLED IN GROOVE ON GENERATOR SHAFT (REF. DETAIL B, FIG. 401).

(a) On any IDG with Sunstrand repair No. 60, install lubricated O-ring in groove on input shaft (Ref. Fig. 401). Install gasket on IDG mounting flange.

(5) Position IDG on handling adapter and transmission jack and align with engine accessory pad.

(6) Align locating pin on IDG mounting flange with mating hole on QAD engine adapter plate. Position QAD ring so lugs align with notches on IDG mounting flange, and move IDG into position.

C (7) Rotate the locking ring to be sure it does not bind and
C engage the tension bolt in the self-aligning nut.
C Continue to support the IDG weight.

C NOTE: Ring must not snag or bend.

C (8) Torque bolt to 12-15 foot-pounds.

C (a) Tap periphery of QAD ring with soft-face mallet to
C center ring and eliminate false torque, then
C retorque.

C (b) Repeat tap-and-torque procedure until torque is
C unaffected by tapping.

C (c) Lower jack before final torquing. Install
C lock-wire (Ref. Fig. 403).

C (8A) Rotate QAD ring clockwise until lugs are fully engaged
C with the lugs on IDG mounting flange, ensuring that the
C ring does not snag or bind. If necessary, adjust jack
C height and attitude of jack base to correct the
C alignment.

C NOTE: 1: In the event the IDG QAD ring appears
C to bottom out, and/or has less than 3/16
C inch gap between the clamp lug, and the IDG
C bracket - use two gaskets Mfr. P/N 693206
C between the IDG ring, and the engine QAD
C ring (Ref. Fig. 403).

NOTE: 2: If QAD ring still bottoms out, or has less than 3/16 inch gap after using two gaskets, remove the IDG and check for wear on the QAD parts. Replace parts as necessary (Ref 24-11-16 Page 401 & 402), and reinstall the IDG. The QAD ring has an inherent tendency to tighten during operation, i.e. the tension bolt loosens. The lock-wire must be installed as shown in Fig. 403 to permit the tension bolt to move through the IDG mounted lug. Periodic re-torque of the tension bolt is required.

C (9) After achieving the above torque level, the tension
C bolt is to be final torqued to 12-15 foot-pounds.

(10) Check for a minimum of 3/16 inch clearance and safety wire as noted in Figure 403.

C C NOTE: If clearance specified cannot be met, see Notes 1 and 2 in step (8A).

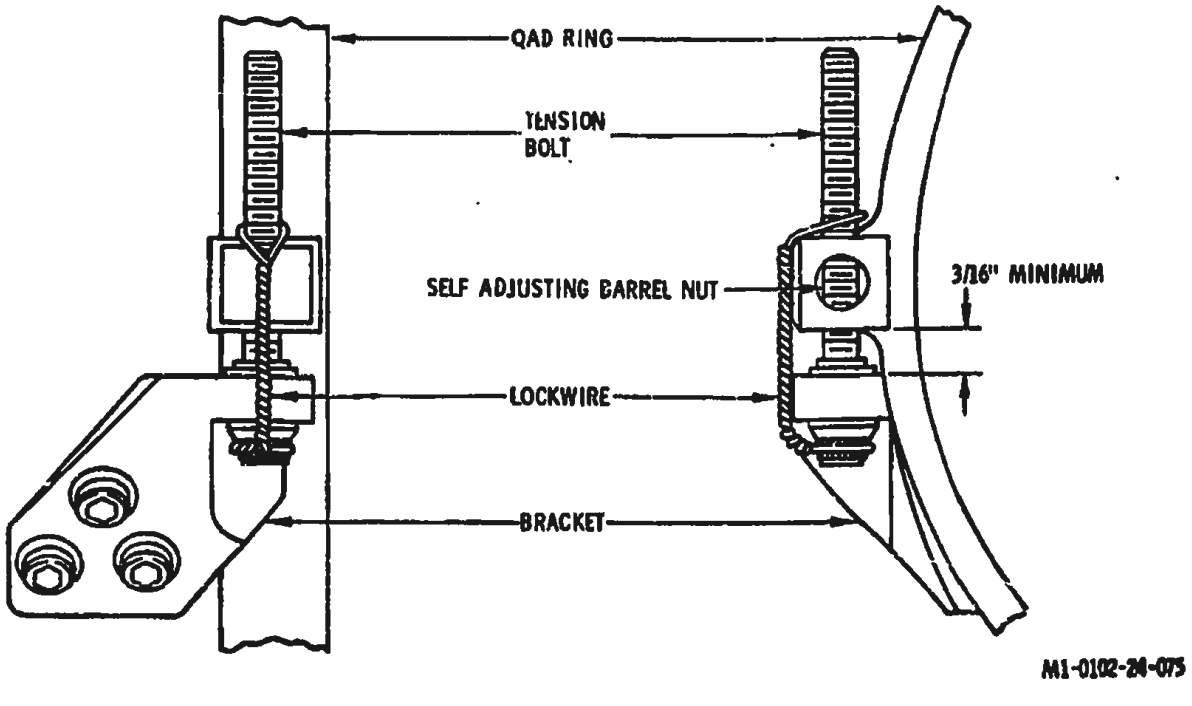
(11) Remove IDG handling adapter and jack.

(12) If IDG assembly was removed as a result of a generator failure, verify that oil cooler and lines have been checked for contamination as outlined in Para. 3A(6).

(13) Install new O-ring on self-closing valve using Acryloid or equivalent for lubrication. Install valve. Torque 30 to 40 lb in. and lock-wire.

(14) Install new O-ring on magnetic plug (if removed) using Acryloid or equivalent for lubrication. Be sure plug is clean (Ref. 24-11-01, Inspection and Check). Install plug. Torque 15 to 20 lb in. and lock-wire.

(15) Install new O-ring on reservoir drain plug using Acryloid or equivalent for lubrication. Install plug. Torque 40 to 55 lb in. and lock-wire.



Lock-wiring Tension Bolt
Figure 403

(16) Uncap openings and connect oil-in and oil-out lines using spanner wrench.

(17) Torque Oil-in lines 375 to 420 lb. in.

(18) Torque Oil-out lines 375 to 420 lb. in.

(19) Install ac generator leads. Torque 162 to 180 lb-in. Connect aircraft wiring connectors.

(20) Fill oil system (Ref. 12-12-21 IDG Oil Replenishing Servicing).

(21) Perform Static Disconnect Test (Ref. 24-11-01, Adjustment and Test, Para. 3B).

(22) Generator Diode Integrity Check

(a) Check for display of generator diode fault call.

(1) Determine whether generator diode fault annunciator is displayed on the generator system failure panel located on right side of the aft wall of the MESC.

(b) Bite check annunciator.

(1) Reset and test the failure panel for proper operation.

(2) If generator failure panel is faulty, replace it. (Ref. 24-20-01, Fig. 103).

(c) Evaluate failure panel indication.

(1) If generator diode(s) (are) is not displayed and failure panel tests satisfactorily, the generator systems are operational. The test is complete.

(2) If generator diode(s) (are) displayed, reset the failure annunciator panel. Start the engine(s) (Ref. 71-00-00) and observe the failure panel as each generator is brought on line.

(3) If generator diode fault annunciator is displayed for any generator, replace the faulty I.D.G.

(23) Start engine (Ref. 71-00-00) and run at idle speed.

(24) Verify that LOW PRESS light in IDG DISCONNECT switchlight on Flight Engineer/Second Officers (FE/SO) ELECTRICAL control panel, zone 215, goes off by the time the engine speed stabilizes.

NOTE: If the light does not go off, disconnect IDG immediately, shut down the engine, and fault-isolate IDG oil system (Ref. 24-11-01, Fig. 102).

(25) Energize generator, rotate meter selector switch on FE/SO ELECTRICAL control panel to applicable generator. Verify that frequency and voltage of output are 400 (±4)Hz and 117 (±2)V ac.

(26) If frequency is not within specified limits, refer to Governor Adjustment (Ref. 24-11-01, Adjustment and Test). If voltage is not within specified limits, replace corresponding generator control unit (Ref. 24-21-05).

(27) Perform Dynamic Disconnect Test (Ref. 24-11-01, Adjustment and Test, Para. 3C).

(28) Shut down engine (Ref. 71-00-00).

(29) Verify that reconnect is accomplished (button remains flush in reset handle).

(30) Inspect IDG for oil leaks (Ref. 24-11-01, Inspection and Check).

(31) Close and secure cowl panels (Ref. 6-40-00).

INTEGRATED DRIVE GENERATOR (IDG) ASSEMBLY - ADJUSTMENT AND TEST

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.020-inch diameter, or equivalent

2. Referenced Procedures

24-20-00	AC Generation System - Fault Isolation
24-11-01	IDG Assembly - Fault Isolation
71-00-00	Power Plant - Adjustment and Test
71-11-00	Cowling Engines No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 Cowling - General Servicing

3. Adjustment/Test

R WARNING: ONLY THE MOST QUALIFIED PERSONNEL WILL BE ASSIGNED TO
R TROUBLE-SHOOTING/ADJUSTMENT PROBLEMS ON ENGINE DURING
R RUN-UP.

R EXPOSURE OF MAINTENANCE PERSONNEL REQUIRED IN THE
R VICINITY OF THE ENGINE DURING RUN-UPS WILL BE KEPT TO
R THE ABSOLUTE MINIMUM.

R MAINTENANCE PERSONNEL ARE FORBIDDEN AROUND THE ENGINE
R DURING RUN-UPS REQUIRING POWER LEVELS BEYOND GROUND
R IDLE.

A. Governor Adjustment

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker LOAD CONT & BUS FAIL IND - BUS 1, BUS 2, or BUS 3 (D10), (D13), or (D16) as applicable. Press GENERATOR BREAKER TRIP switchlight for applicable IDG. Verify that OPEN light in switchlight comes on.

(2) Start applicable engine (Ref. 71-00-00) and run at idle speed.

(3) On Flight Engineer/Second Officers electrical control panel, zone 215, rotate volts-frequency selector switch to applicable generator and note frequency on FREQ

meter to determine amount of adjustment needed. The normal operating frequency is 400 (±1) Hz.

(4) Stop applicable engine (Ref. 71-00-00).

(5) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

(6) Remove lock-wire and turn governor adjustment screw to adjust frequency to 400 (±1)Hz (Ref. Fig. 501).

NOTE: One full turn clockwise will increase frequency approximately 4 Hz, and one full turn counterclockwise will decrease frequency approximately 4 Hz.

(7) R Secure adjustment screw with lock-wire using care to avoid changing the adjustment screw setting.

(8) Close and lock cowl panels.

(9) Restart engine and recheck frequency for 400 (±1) Hz. If necessary, shut down engine and repeat adjustment procedure.

(10) R Remove tag and close circuit breaker opened in Step 3A(1). Frequency must remain within 400 (±1) Hz limits. If out of tolerance, fault-isolate real load R division circuit (Ref. 24-11-00, Fig. 103).

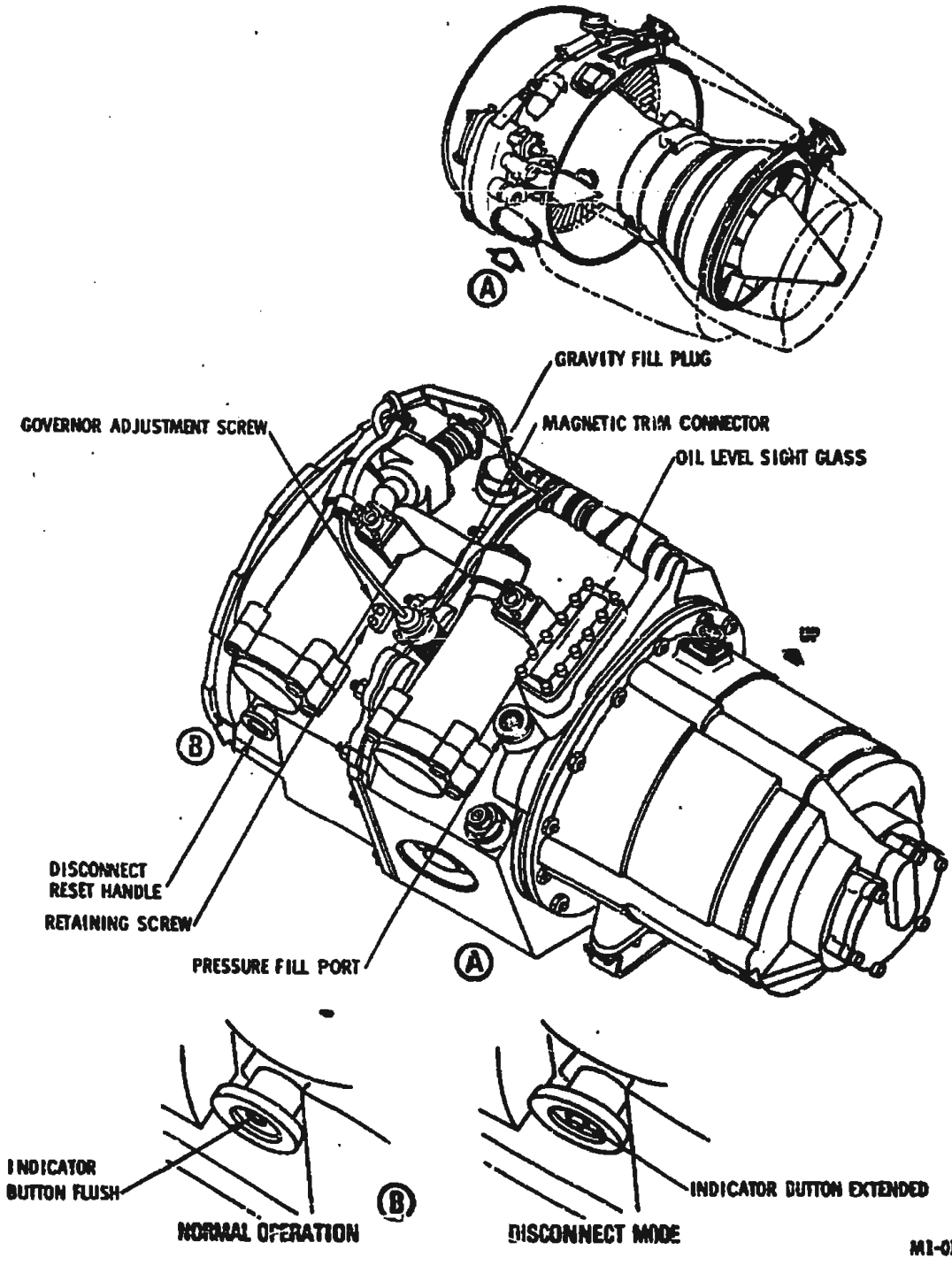
NOTE: The purpose of the following disconnect tests is to check the disconnect actuating mechanism. If the mechanism operates properly, continued rotation of the input spline will separate the disconnect dog teeth, thus completing the disconnect operation. Either of the subsequent procedures may be followed.

B. Disconnect Test (Static Condition)

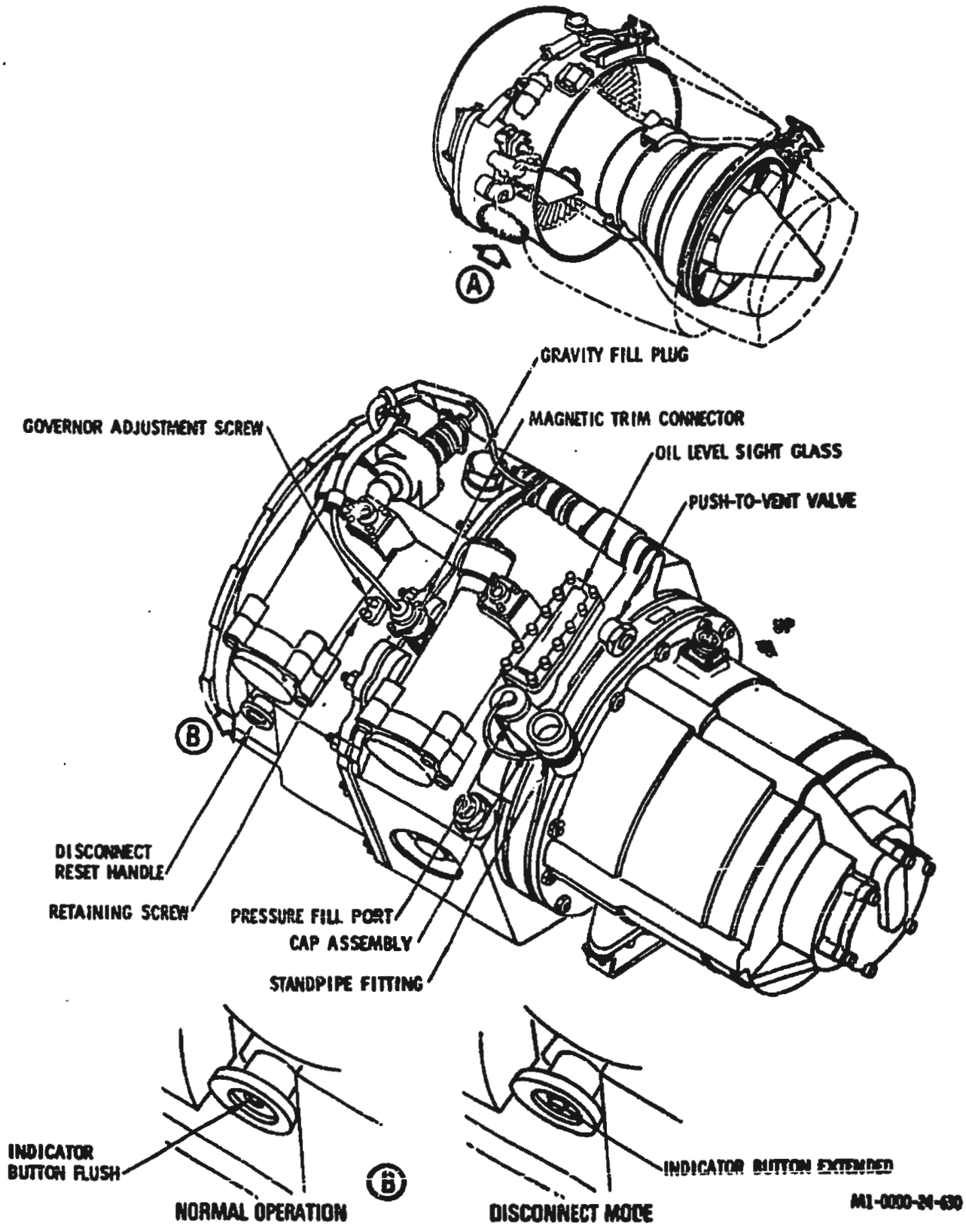
CAUTION: DO NOT PRESS IDG DISCONNECT SWITCHLIGHT FOR PERIODS LONGER THAN 3 SECONDS. ALLOW A MINIMUM OF 60 SECONDS COOLING TIME BETWEEN ACTUATION PERIODS.

DO NOT PERFORM STATIC TEST WHILE ENGINE IS ROTATING. DAMAGE TO DRIVE SPLINE AND ENGINE GEAR MAY RESULT.

(1) Open cowl panels for engine No. 1, No. 2, or No. 3.



Adjustment and Test Points on IDG
Figure 501



Adjustment and Test Points on IDG
Figure 501

(2) On FE/SO ELECTRICAL CONTROL panel, zone 215, press IDG DISCONNECT - LOW PRESS switchlight for IDG to be tested.

(a) Actuation of the disconnect plunger can be detected by checking the pop-out indicator button in the disconnect reset handle (Ref. Fig. 501). If the button is flush with the face of the handle, the disconnect plunger has not actuated. If the indicator button is extended out from the face of the handle, depress the indicator. If the button resets, the disconnect plunger has not actuated. If the button does not reset, the disconnect plunger has actuated.

(b) If the disconnect does not actuate properly, initiate fault isolation procedures for the IDG
R disconnect circuit (REf. 24-11-00, Fig 107 and
R 104). If the aircraft electrical circuit and IDG connections are not defective, remove the IDG and return to the overhaul facility.

(3) Pull out the reset handle on the IDG until the solenoid plunger is felt to snap back into position (the handle should move approximately 3/8 inch).

(a) Allow the disconnect handle to return slowly to the maximum inward position. Press in disconnect indicator button to reset.

(b) If the disconnect does not reset properly, remove the IDG and return to the overhaul facility.

(4) Slowly pull the disconnect reset handle to the outward travel limit noting the amount of hand force required. The force will be noticeably less than in Step (3) above and there will be no audible indication of the solenoid plunger resetting.

(5) Slowly return disconnect handle to the maximum inward position. Press in disconnect indicator button to reset.

(6) Close and secure cowl panels.

C. Disconnect Test (Dynamic Conditions)

(1) Start engine corresponding to IDG to be tested (Ref. 71-00-00).

(2) On FE/SO Electrical Panel, zone 215, place volts-frequency selector switch in position which

corresponds to running engine. Verify 400 (±1) Hz on adjacent FREQ indicator.

CAUTION: DO NOT PRESS IDG DISCONNECT SWITCHLIGHT BELOW MINIMUM ENGINE IDLE SPEED. DAMAGE MAY OCCUR AS A RESULT OF AN INCOMPLETE DISCONNECT.

DO NOT PRESS IDG DISCONNECT SWITCHLIGHT FOR PERIODS LONGER THAN 3 SECONDS. ALLOW A MINIMUM OF 60 SECONDS COOLING TIME BETWEEN ACTUATION PERIODS.

(3) On FE/SO ELECTRICAL panel, press IDG DISCONNECT - LOW PRESS switchlight for IDG to be tested.

NOTE: the Generator oil LOW PRESS light for the disconnected generator will come on and remain on.

(4) After disconnect, select applicable generator on ac meters selector switch, press PMG TEST switch, and verify that AC VOLTS meter indicates PMG OFF.

(5) Stop engine (Ref. 71-00-00).

(6) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00) and verify disconnect plunger actuation.

(a) Actuation of the disconnect can be confirmed by checking the pop-out indicator button in the disconnect reset handle (Ref. Fig. 501). If the button is flush with the face of the handle, the disconnect has not actuated. If the button is extended from the face of the handle, the disconnect has actuated.

CAUTION: DO NOT ATTEMPT TO RESET THE DISCONNECT UNTIL THE ENGINE ROTATION HAS STOPPED AS DAMAGE TO THE DISCONNECT DOG TEETH CAN OCCUR.

(7) Pull out the reset handle on the IDG until the solenoid plunger is felt to snap back into position (the handle should move approximately 3/8 inch). Press in disconnect indicator button to reset.

(8) At the next engine run, observe that the generator operates normally at a frequency of 400 (±1) Hz.

R (9) Close and secure cowl panels.

IDG ASSEMBLY - INSPECTION AND CHECK

1. Equipment and Materials

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Lubricant, Acryloid, Rohm and Haas, HF825, or equivalent

O-ring (Ref. Fig. 601)

2. Referenced Procedures

24-11-01	IDG Assembly - Servicing
24-11-01	IDG Assembly - Removal and Installation
24-11-02	IDG Transmission Oil Filters - Removal and Installation

3. Inspection/Check

Perform IDG maintenance actions listed in Table 601 in accordance with airline time limits and maintenance standards. An IDG is located on each engine accessory drive gearbox to right of bottom centerline in zones 412, 422, and 432.

Inspection and Check Maintenance Actions
Table 601

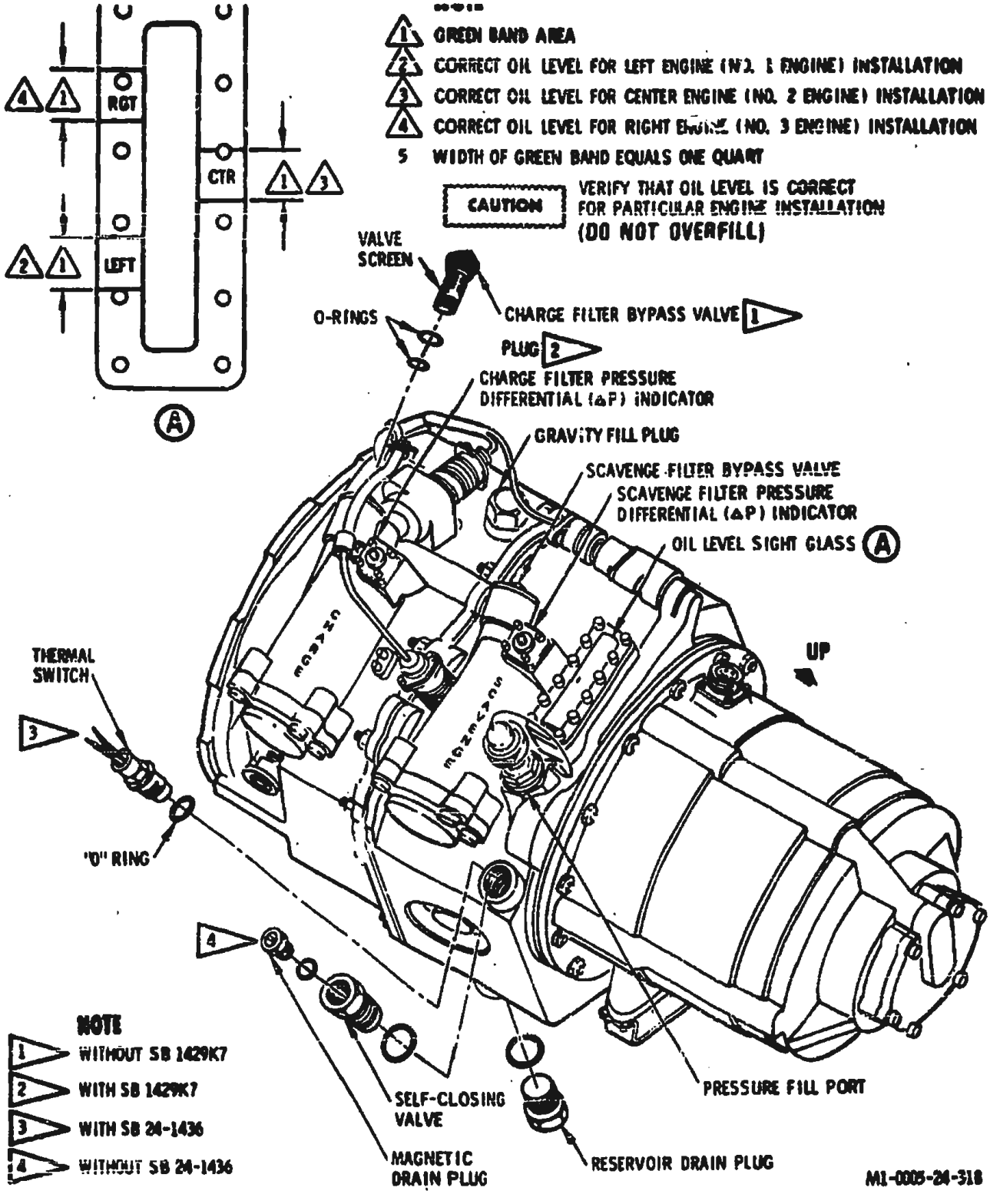
	MAINTENANCE ACTION	REFERENCE
	A. Visual Check	
	(1) Oil leaks	
	B. Differential Pressure Indicator Check	
	CAUTION: DO NOT DEPRESS INDICATOR BUTTONS.	
CR CR	(1) Indicator buttons on top of filter cases must be flush with indicator face. If either button is extended, check charge and scavenge filters.	

Inspection and Check Maintenance Actions (Cont)
Table 601

	MAINTENANCE ACTION	REFERENCE
	NOTE: On aircraft with Sundstrand SB24-1413 the charge filter differential pressure indicator is lockwired inoperative or replaced with a blank indicator.	
R	If charge filter metallic or non-metallic contamination is visible, or scavenge filter physical damage (pressure collapse, heat damage) is evident the oil cooler may be contaminated. The oil cooler must be removed and replaced (Ref. 24-11-08), and oil lines thoroughly flushed with clean oil. Small amounts of non-metallic contamination in the scavenge filter are acceptable, if there is no physical damage. If the Scavenge Filter shows bright metal deposits this indicates internal damage and IDG should be replaced.	24-11-01 Servicing
	C. Oil level check (1) Wait a minimum of 5 minutes after shutdown.	
	(2) On aircraft without SB24-082, oil level must be within applicable green band area of sight glass, depending on installation location.	
	(2) On aircraft with SB24-082, check for low oil condition by checking if the oil level is at or below the line applicable to installation location. If oil level is low, check for leaks and service.	
	D. Quick Attach-Detach (QAD) Ring Security Check	
C C C C C C C C C	(1) Verify tightness of QAD ring by removing safety wire and re-torquing the tension bolt. (a) If bolts turns in tightening direction at minimum torque of 144 inch pounds, torque to 180 inch-pounds while tapping outer periphery of QAD ring with soft mallet. (Ref. 24-11-01, Removal and Installation). (b) Final torque 180 inch-pounds.	

Inspection and Check Maintenance Actions (Cont)
Table 601

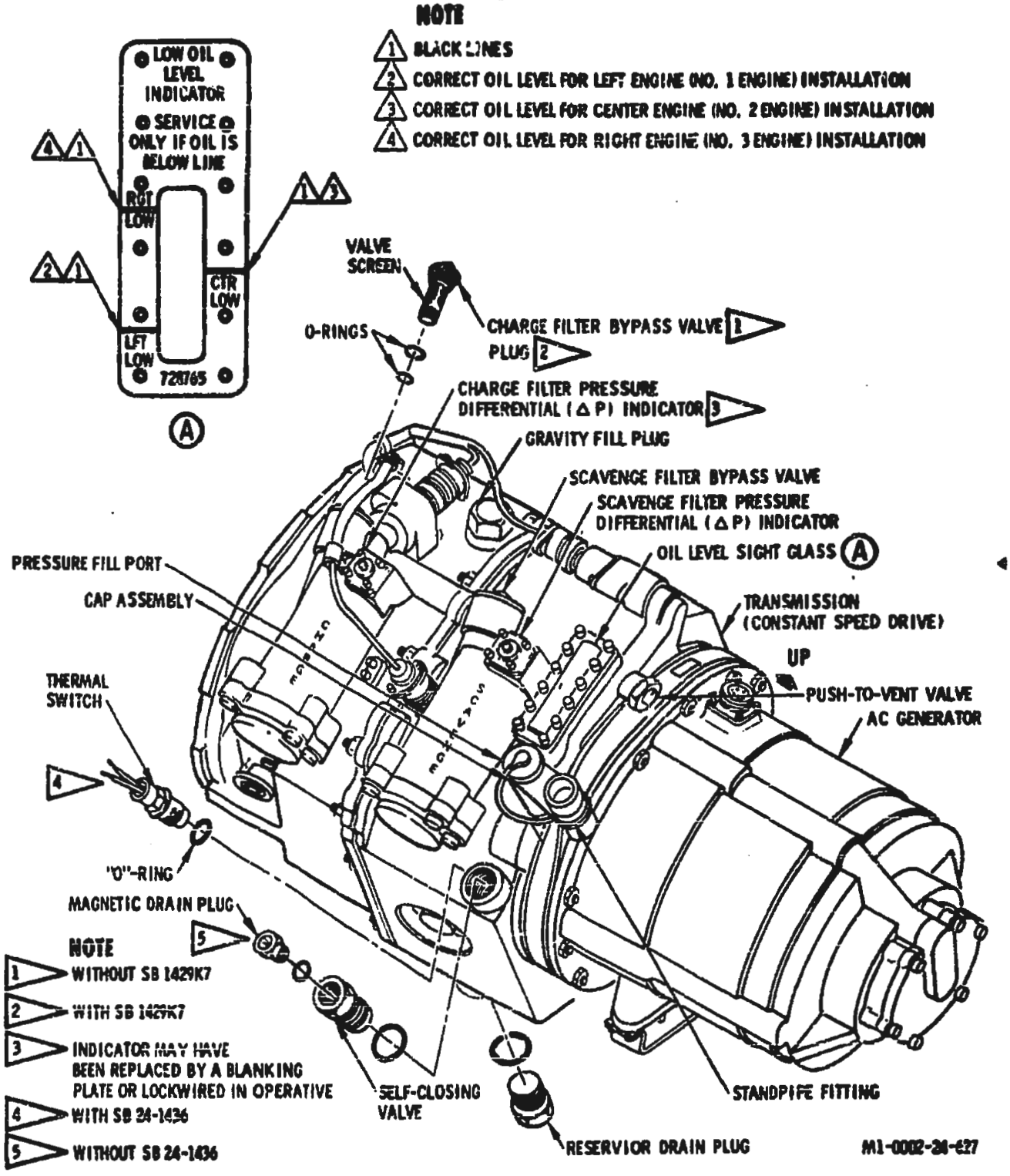
	MAINTENANCE ACTION	REFERENCE
C C C C	(2) If after re-torque the gap between the clamp lugs is three-sixteenths or less, remove the IDG and install 2 gaskets. (Ref 24-11-01, paragraph (8) Notes 1 and 2.)	24-11-01, Removal and Installation
	E. Mechanical Inspection	
R R R R	(1) Check all external parts for mechanical defects such as looseness, cracks, leaks, broken or missing lock-wire. If defect is found, repair or replace.	
R R R R	F. Magnetic Plug Check (1) Remove magnetic plug (Ref. Fig. 601). (2) Inspect magnetic plug according to Figure 601	
R R	CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL O-RINGS.	
R R	VERIFY THAT O-RINGS ARE NOT STRETCHED OR DAMAGED DURING UNPACKAGING OR INSTALLATION.	
R R R R R	(3) Install new O-ring on magnetic plug using acryloid or equivalent for lubrication.	
R R	(4) Install magnetic plug. Torque 15 to 20 lb in. and lock-wire.	


1 GREEN BAND AREA
2 CORRECT OIL LEVEL FOR LEFT ENGINE (NO. 1 ENGINE) INSTALLATION
3 CORRECT OIL LEVEL FOR CENTER ENGINE (NO. 2 ENGINE) INSTALLATION
4 CORRECT OIL LEVEL FOR RIGHT ENGINE (NO. 3 ENGINE) INSTALLATION
5 WIDTH OF GREEN BAND EQUALS ONE QUART
CAUTION VERIFY THAT OIL LEVEL IS CORRECT FOR PARTICULAR ENGINE INSTALLATION (DO NOT OVERFILL)
RGT
CTR
LEFT
A
VALVE SCREEN
O-RINGS
CHARGE FILTER BYPASS VALVE 1
PLUG 2
CHARGE FILTER PRESSURE DIFFERENTIAL (ΔP) INDICATOR
GRAVITY FILL PLUG
SCAVENGE FILTER BYPASS VALVE
SCAVENGE FILTER PRESSURE DIFFERENTIAL (ΔP) INDICATOR
OIL LEVEL SIGHT GLASS A
UP
THERMAL SWITCH 3
"O" RING
4
SELF-CLOSING VALVE
MAGNETIC DRAIN PLUG
RESERVOIR DRAIN PLUG
PRESSURE FILL PORT
NOTE
1 WITHOUT SB 1429K7
2 WITH SB 1429K7
3 WITH SB 24-1436
4 WITHOUT SB 24-1436
M1-0005-24-318

R IDG Assembly Magnetic Plug Inspection
R Figure 601 (Sheet 1)

EFFECTIVITY: WITHOUT SB24-082

0018



R IDG Assembly Magnetic Plug Inspection
R Figure 601 (Sheet 1)

R EFFECTIVITY: WITH SB24-082
R
001B

NORMAL-SMALL AMOUNT OF FUZZ-CLEAN AND REPLACE

HEAVY DEPOSITS OF FUZZ-CLEAN, REPLACE, AND RECHECK AFTER TEST RUN

BRIGHT METAL CHIPS OR FLAKES-REMOVE AND REPLACE

M1-0300-24-1105

R IDG Assembly Magnetic Plug Inspection
R Figure 601 (Sheet 2)

INTEGRATED DRIVE GENERATOR (IDG) TRANSMISSION OIL FILTER ELEMENTS - REMOVAL AND INSTALLATION

1. Equipment and Materials

Container (2 quarts, minimum)

Lubricant, Acryloid, Rohm and Hass, HF825, or equivalent

O-rings (Ref. Fig. 401)

Filter elements, Sundstrand Aviation, or equivalent (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-11-01	IDG Assembly - Servicing
24-11-01	IDG Assembly - Inspection and Check
71-00-00	Power Plant - Adjustment and Test
71-11-00	Cowling Engine No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 Cowling - General Servicing

3. Removal/Installation

A. Removal

(1) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

(2) On aircraft without SB24-082, cut safety wire and loosen gravity fill plug to relieve internal pressure (Ref. Fig. 401).

R WARNING: PUSHING THE VENT RELIEF VALVE MAY CAUSE SOME OIL
R TO SPRAY OUT OF VENT. AFTER PUSHING THE PRESSURE
R RELIEF VALVE, PERSONNEL SHOULD STAND BACK A SAFE
R DISTANCE.

(2) On aircraft with SB24-082.
press push-to-vent valve to relieve internal pressure (Ref. Fig. 401).

CAUTION: WHEN WORKING ON IDG OIL SYSTEM USE EXTREME CARE TO KEEP THE SYSTEM CLEAN.

(3) Remove screws and washers from each filter cap.

CAUTION: DO NOT USE A SCREW DRIVER TO SEPARATE FILTER CAP FROM CASE. PULL DOWNWARD WITH A SLIGHT TWISTING MOTION. IF NECESSARY, TAP DOWNWARD WITH A SOFT-FACED MALLET.

(4) Position container under filter caps, and remove caps.

(5) Remove filter elements from filter cavities.

(6) Inspect filter elements (Ref. 24-11-01).

B. Installation.

R WARNING: LOCTITE ADHESIVE AND PRIMER ARE TOXIC. USE IN WELL VENTILATED AREA. PREVENT EYE AND SKIN CONTACT AND DO NOT BREATHE VAPORS. IN CASE OF EYE CONTACT, FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. IN CASE OF SKIN CONTACT, WASH WITH SOAP AND WATER.

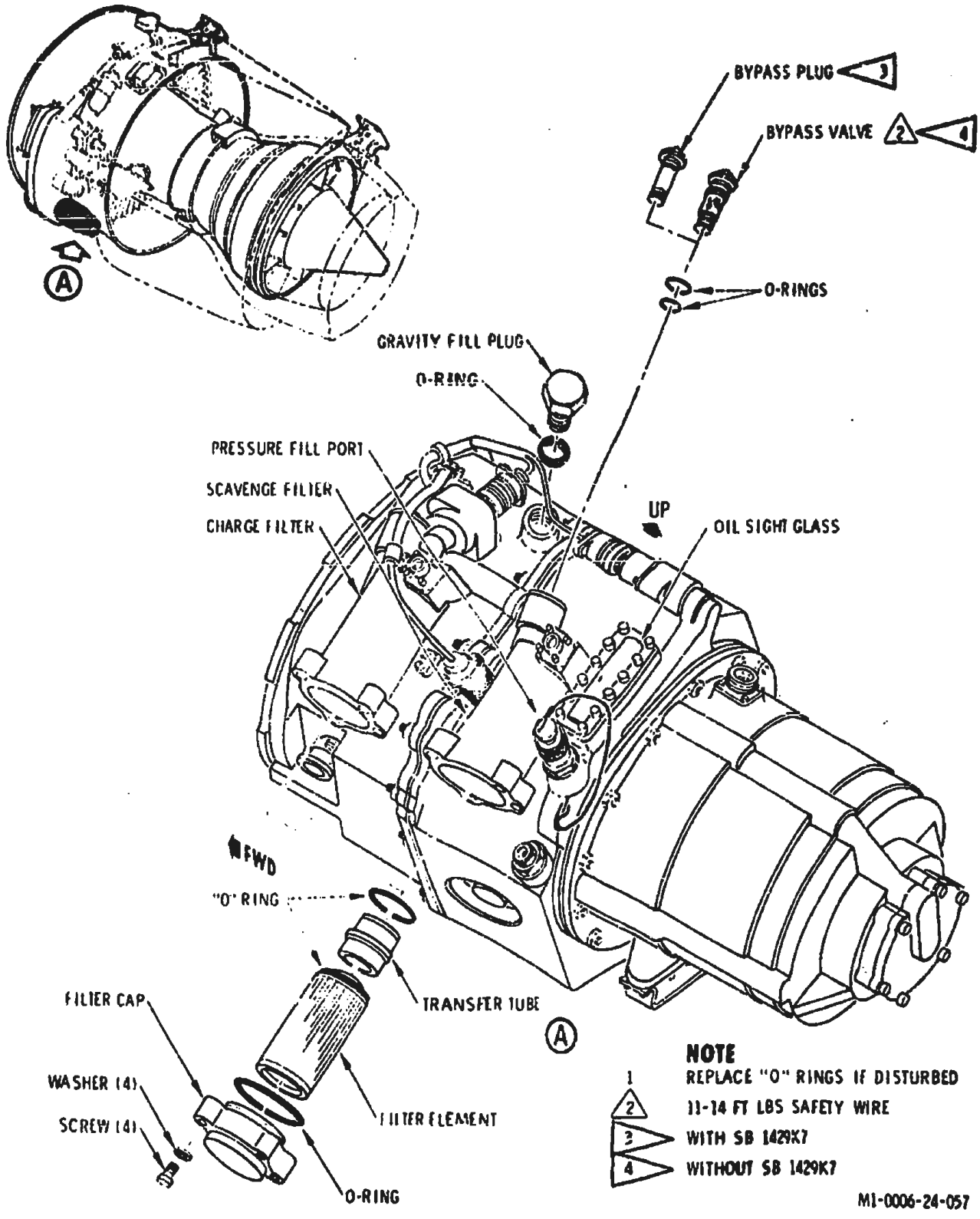
CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL O-RINGS.

(1) Wipe filter caps clean with a lint-free cloth and install new O-rings.

CAUTION: FILTER ELEMENTS MUST BE CORRECTLY SEATED. DO NOT ATTEMPT TO DRAW ELEMENTS INTO POSITION BY TIGHTENING CAP SCREWS. BE SURE FILTER CAP IS FULLY SEATED BEFORE TIGHTENING MOUNTING SCREWS.

R (2) Install new O-rings on new filter elements. Mate filter caps and filter elements before installing in filter cavity.

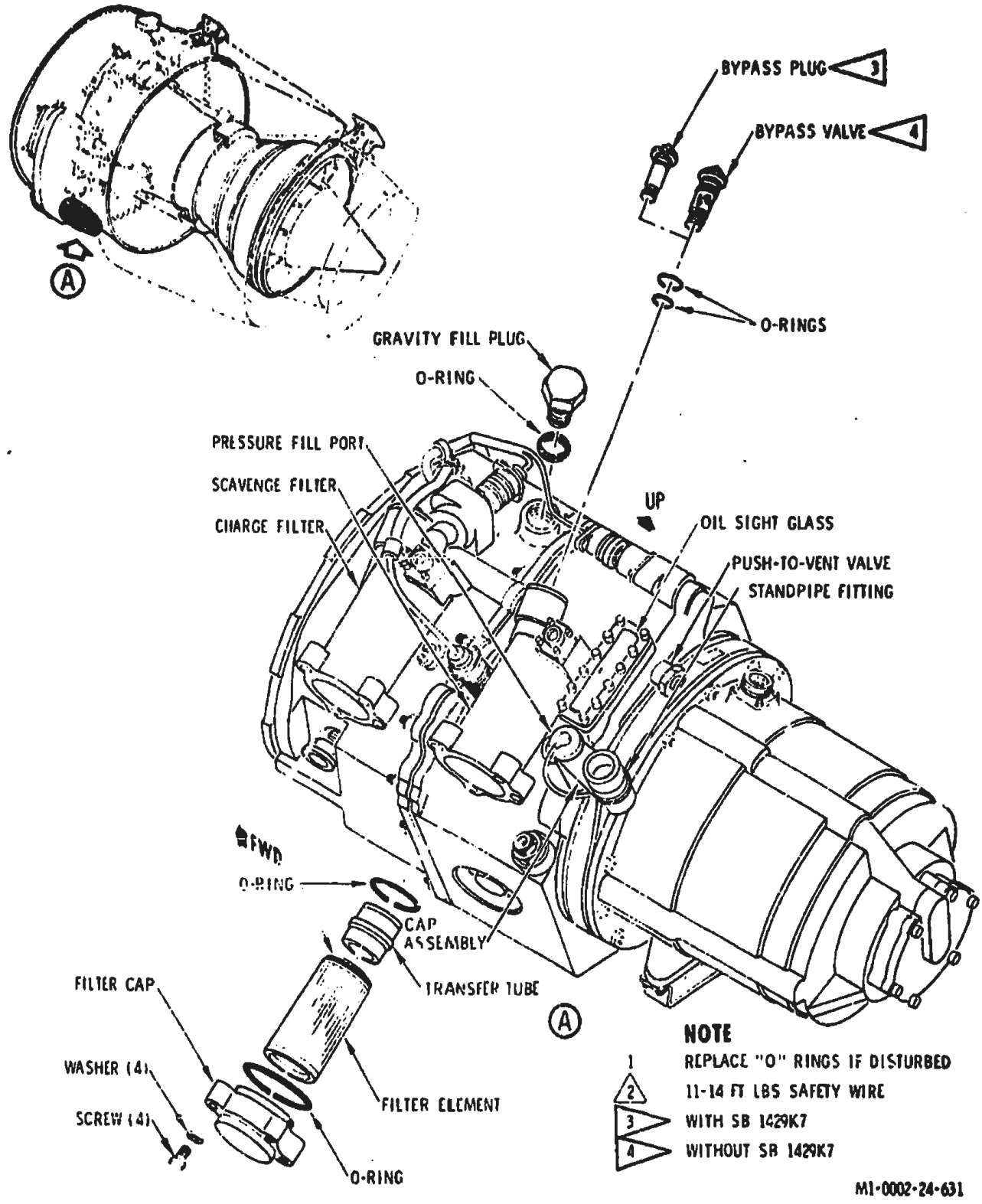
NOTE: If the transfer tube, Loctited to the filter bowl, becomes loose during filter replacement remove Loctite residue from housing and replace with transfer tube and O-ring.



R IDG Transmission Oil Filter Elements - Removal and Installation
R Figure 401

EFFECTIVITY: WITHOUT SB-082, SUNDSTRAND
24-1443 24-1441

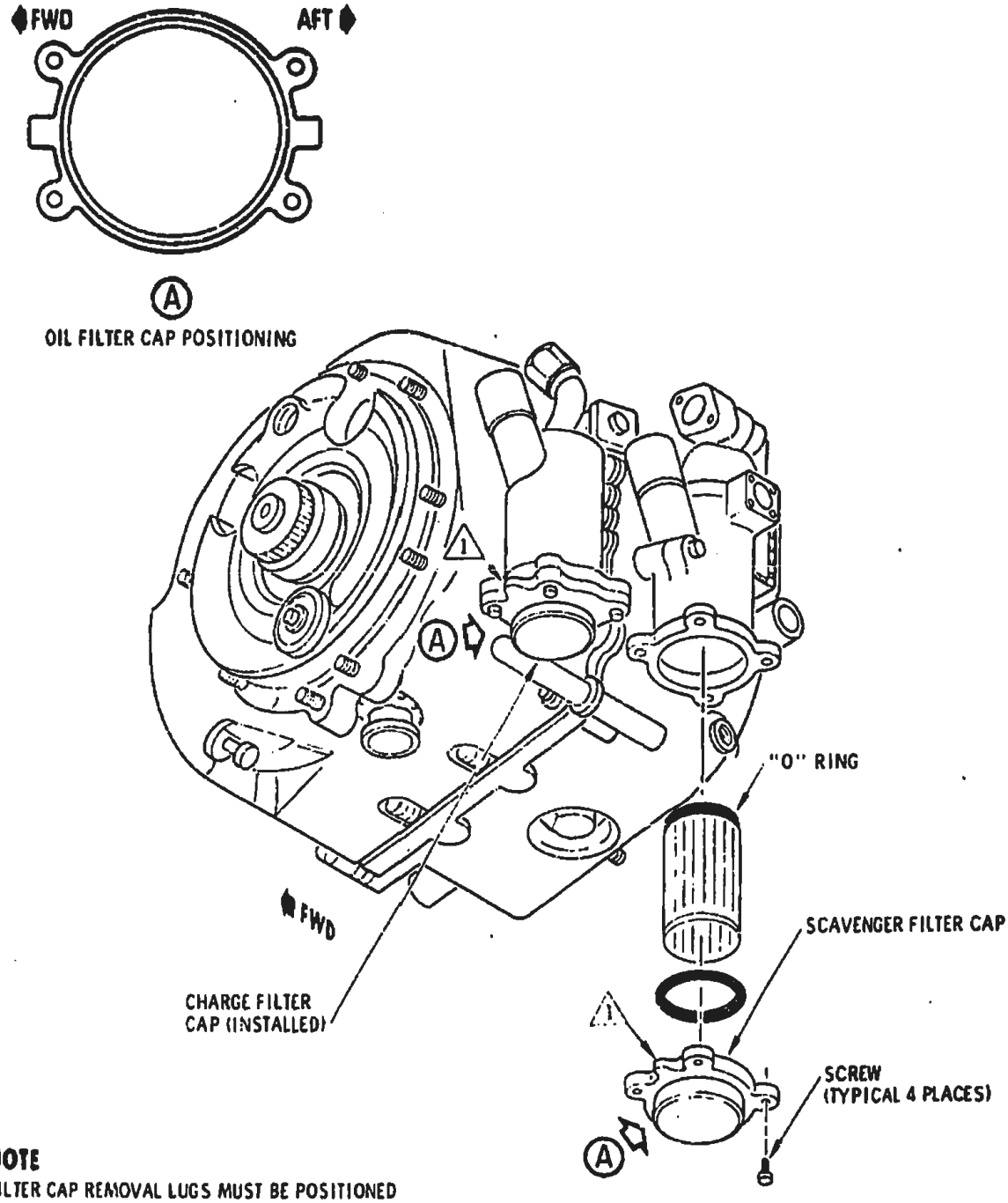
001B



R IDG Transmission Oil Filter Element - Removal and Installation
R Figure 401

EFFECTIVITY: WITH SB-082, SUNDSTRAND 24-1441, 24-1443

001B



R IDG Transmission Oil Filter Cap-Positioning and Installation
R Figure 402

CAUTION: FILTER CAPS MUST BE CORRECTLY POSITIONED, SEE FIGURE 402, AND FULLY SEATED, BEFORE INSTALLING/TIGHTENING CAP RETAINING SCREWS. INCORRECT FILTER CAP POSITIONING CAN CAUSE RETAINING SCREW LUGS TO FRACTURE WITH RESULTING IDG OIL LOSS.

(3) Reinstall filter caps by hand, with the removal lugs positioned as shown in Figure 402.

(4) Reinstall filter caps and torque screws 8 to 9 lb ft. Wipe filter caps and adjacent area clean.

(5) On aircraft without SB24-082, service with oil, torque gravity fill plug 10 to 12 lb. ft, and lock-wire. Check that oil level is within green band area of sight glass.

(5) On aircraft with SB24-082, service with oil and replace cover. Oil level is automatically set by standpipe. Oil level can be verified by seeing that it is at or above the appropriate black line on indicator plate.

(6) Motor engine for 2 minutes (Ref. 71-00-00).

(7) Check filter caps for leakage. If leaking, replace seals rather than attempting to increase torque on screws.

(8) Close and secure cowl panels.

INTEGRATED DRIVE GENERATOR (IDG) TRANSMISSION FILTER BYPASS VALVE - REMOVAL AND INSTALLATION

1. Equipment and Materials

O-rings (Ref. Fig. 401)

Lubricant, Acryloid, Rohm and Haas, HF825, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-11-01	IDG Assembly - Servicing
71-00-00	Power Plant - Adjustment and Test
71-11-00	Cowling Engines No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 Cowling - General Servicing

3. Removal/Installation

A. Removal

(1) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 433AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

CAUTION: WHEN WORKING ON IDG OIL SYSTEM USE EXTREME CARE TO KEEP SYSTEM CLEAN.

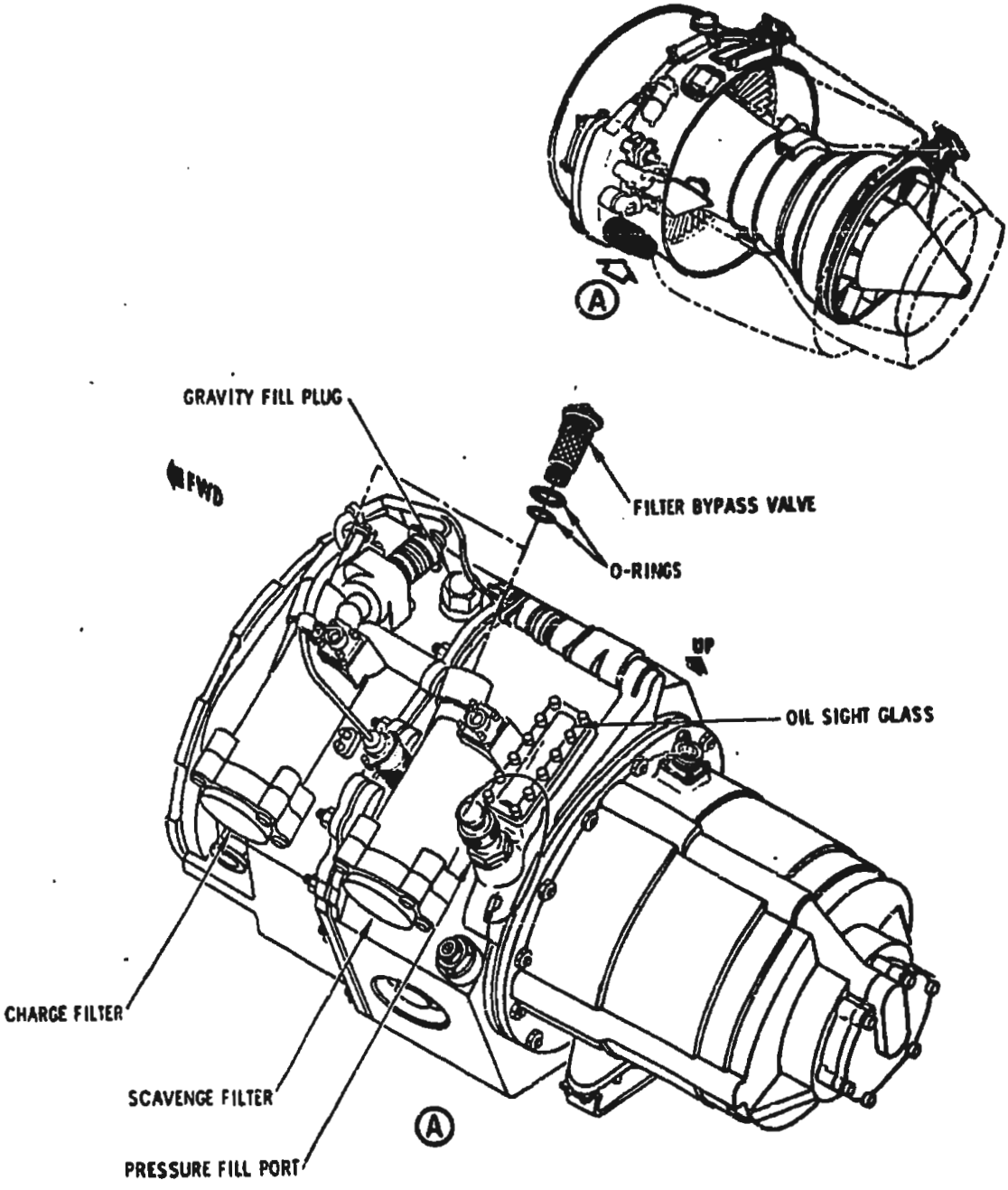
(2) On aircraft without SB24-082, cut safety wire and loosen gravity fill plug to relieve pressure (Ref. Fig. 401).

R WARNING: PUSHING THE VENT RELIEF VALVE MAY CAUSE SOME OIL
R TO SPRAY OUT OF VENT. AFTER PUSHING THE PRESSURE
R RELIEF VALVE, PERSONNEL SHOULD STAND BACK A SAFE
R DISTANCE.

(2) On aircraft with SB24-082, press push-to-vent to relieve pressure (Ref. Fig. 401).

(3) Unscrew filter bypass valve from case.

B. Installation



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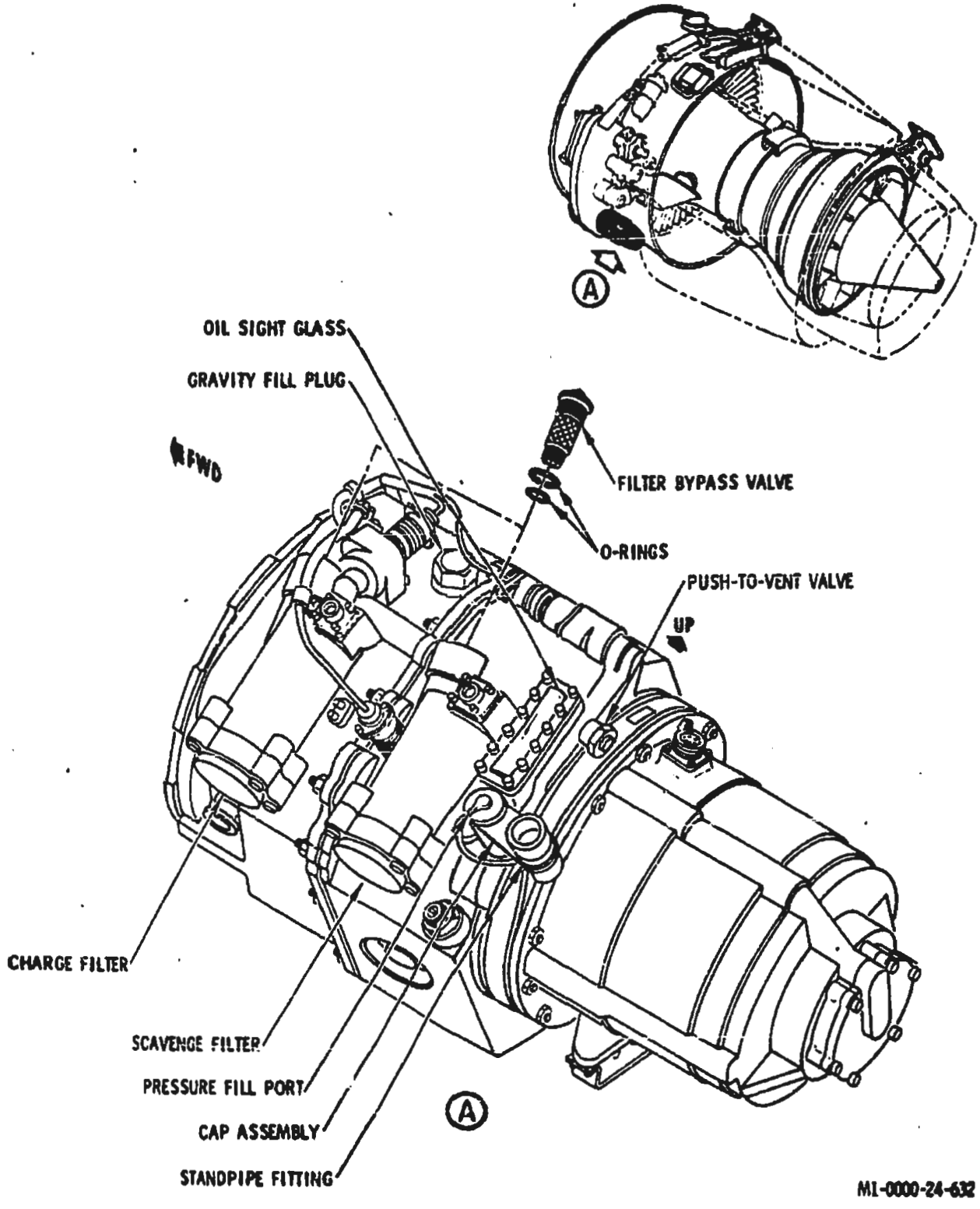
R IDG Filter Bypass Valve - Removal and Installation
R Figure 401

EFFECTIVITY: WITHOUT SB-082, SUNDSTRAND 24-1441, 24-1443

001B



IDG Filter Bypass Valve - Removal and Installation
Figure 401

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL TRANSMISSION O-RINGS.

(1) Install bypass valve assembly in transmission case using new O-rings.

(2) Torque bypass valve assembly 11 to 14 lb in., and lock-wire.

(3) Check oil level and replenish as necessary (Ref. 24-11-01).

(4) On aircraft without SB24-082, torque gravity fill plug, 10 to 12 lb ft, and lock-wire.

NOTE: On aircraft with SB24-082, Push-to-vent valve automatically seals IDG.

(5) Motor engine for two minutes (Ref. 71-00-00) and check for oil leaks. Repair leaks and recheck.

(6) Close and secure cowl panels.

INTEGRATED DRIVE GENERATOR (IDG) DIFFERENTIAL PRESSURE INDICATORS REMOVAL AND INSTALLATION

1. Equipment and Materials

Differential Pressure Indicator, Sundstrand Aviation, or equivalent (Ref. Fig. 401)

O-rings (Ref. Fig. 401)

Lubricant, Acryloid, Rohm and Haas, HF825, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-11-01	IDG Assembly - Servicing
71-CC-00	Power Plant - Adjustment and Test
71-11-00	Cowling Engine No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 cowling - General Servicing

3. Removal/Installation

A. Removal

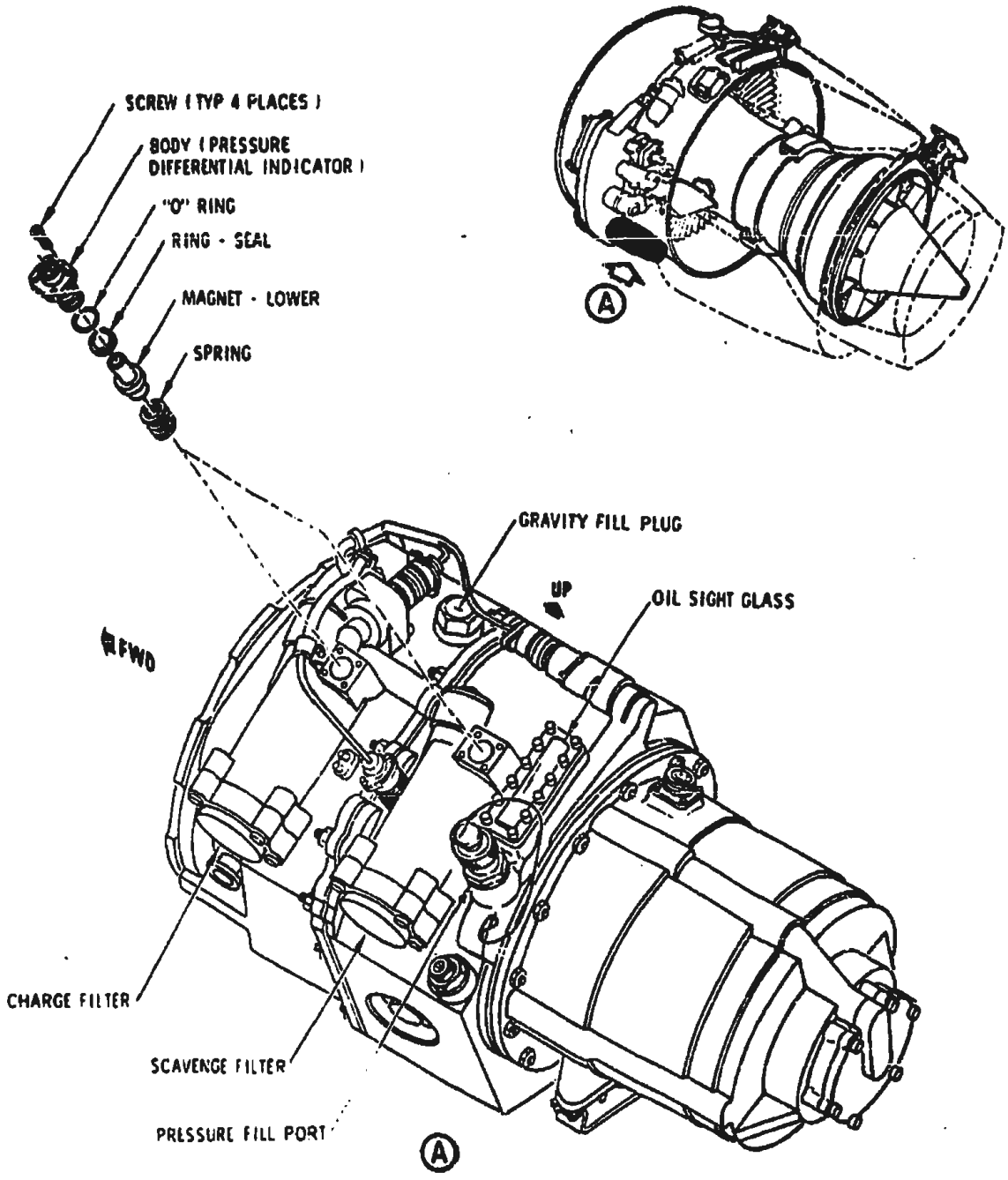
(1) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 433AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

CAUTION: USE EXTREME CARE TO KEEP SYSTEM CLEAN WHEN WORKING ON IDG OIL SYSTEM.

(2) On aircraft without SB24-082, cut safety wire and loosen gravity fill plug to relieve pressure (Ref. Fig. 401).

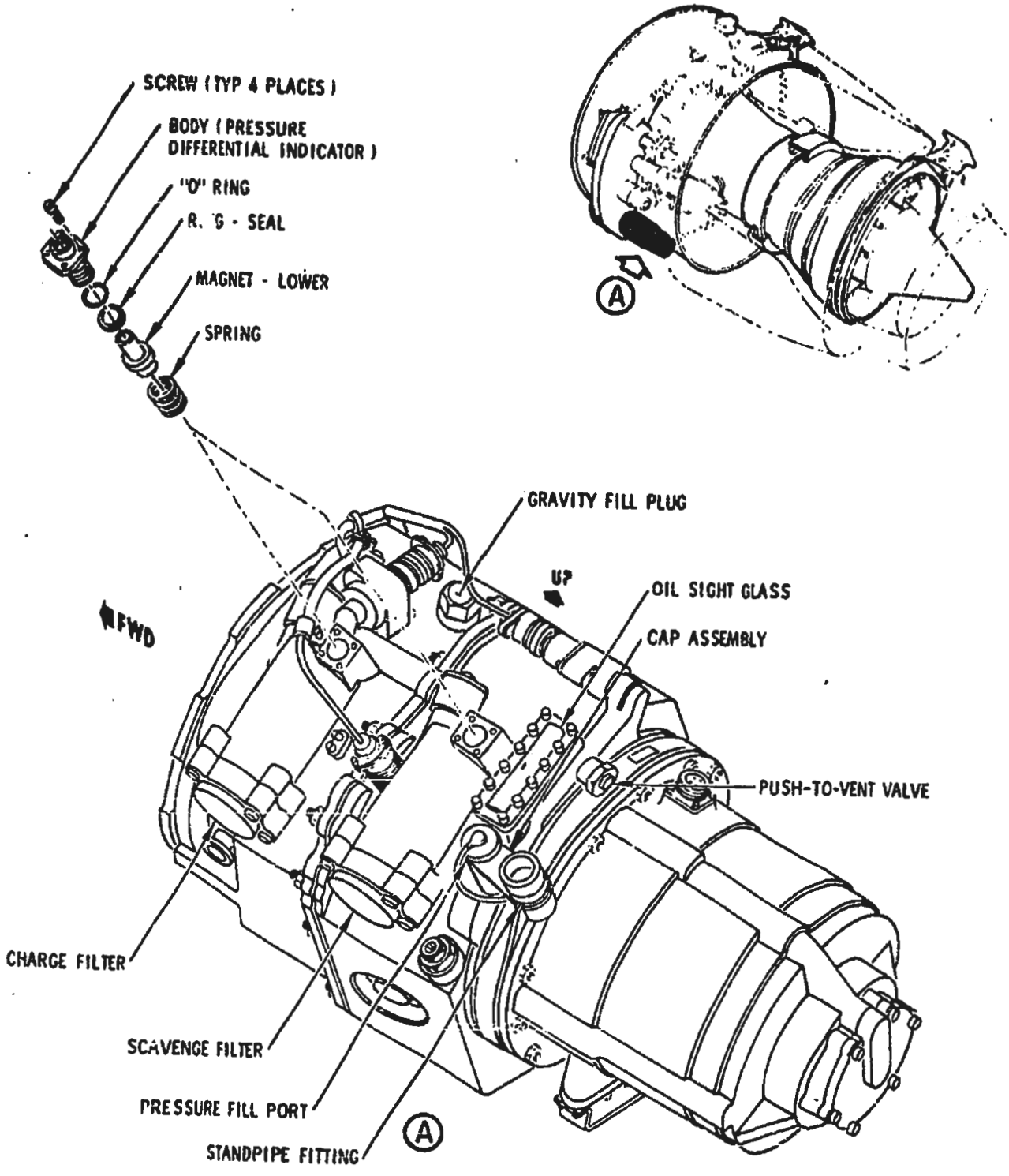
R WARNING: PUSHING THE VENT RELIEF VALVE MAY CAUSE SOME OIL
R TO SPRAY OUT OF VENT. AFTER PUSHING THE PRESSURE
R RELIEF VALVE, PERSONNEL SHOULD STAND BACK A SAFE
R DISTANCE.

(2) On aircraft with SB24-082, press push-to-vent valve to relieve internal pressure (Ref. Fig. 401).



R IDG Differential Pressure Indicators
R Removal and Installation
R Figure 401

EFFECTIVITY: WITHOUT SB24-082, SUNDSTRAND 24-1441, 24-1443



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IDG Differential Pressure Indicators
Removal and Installation
Figure 401

R EFFECTIVITY: WITH SB24-082, SUNDSTRAND 24-1441,
R 24-1443
001B

(3) Remove screws and pull indicator assembly from transmission case.

NOTE: There is a free spring installed behind the indicator; do not lose spring when removing the indicator.

B. Installation

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL IDG O-RINGS.

(1) Install new O-rings on indicator assembly.

(2) Install spring and indicator assembly in IDG housing opening and secure with screws.

(3) Torque screws 7-1/2 to 8 lb-in.

(4) If indicator button is extended, press to reset.

(5) Check oil level and replenish if necessary (Ref. 24-11-01).

(6) On aircraft without SB24-082, torque gravity fill plug 10 to 12 lb-ft, and lock-wire.

NOTE: On aircraft with SB24-082, push-to-vent valve automatically seals IDG.

(7) Motor engine for 2 minutes (Ref. 71-00-00) and check for oil leaks; repair leaks and recheck.

(8) Close and secure cowl panels.

INTEGRATED DRIVE GENERATOR (IDG) TRANSMISSION OIL TEMPERATURE PROBES - REMOVAL AND INSTALLATION

1. Equipment and Materials

Temperature Probe, Sundstrand Aviation, or equivalent (Ref. Fig. 401)

O-ring (Ref. Fig. 401)

Lubricant, Acryloid, Rohm and Haas, HF825, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Container (10 quarts, minimum)

2. Referenced Procedure

24-11-01	IDG Assembly - Servicing
71-00-00	Power Plant - Adjustment and Test
71-11-00	Cowling Engines No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 Cowling - General Servicing

3. Removal/Installation

A. Removal

(1) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

CAUTION: WHEN WORKING ON IDG OIL SYSTEM USE EXTREME CARE TO KEEP SYSTEM CLEAN.

(2) On aircraft without SB24-082, loosen gravity fill plug to relieve pressure (Ref. 24-11-04, Fig. 401).

R WARNING: PUSHING THE VENT RELIEF VALVE MAY CAUSE SOME OIL
R TO SPRAY OUT OF VENT. AFTER PUSHING THE PRESSURE
R RELIEF VALVE, PERSONNEL SHOULD STAND BACK A SAFE
R DISTANCE.

(2) On aircraft with SB24-082, press push-to-vent valve to relieve internal pressure (Ref. 24-11-04 Fig. 401).

(3) When removing the oil-in probe, position container under IDG and remove RSVR DR (reservoir drain) plug to drain oil from transmission.

NOTE: It is not necessary to drain oil when removing the oil-out probe.

(4) Remove electrical connector from temperature probe to be removed.

(5) Unscrew temperature probe and remove from transmission case.

B. Installation

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL IDG O-RINGS.

(1) Install temperature probe in IDG case using new O-ring. Torque temperature probe 40 to 45 lb in.

(2) Connect electrical connector and lock-wire.

(3) If IDG was drained to remove oil-in probe, reinstall reservoir drain plug using new O-ring. Torque plug 40 to 55 lb in., and lock-wire.

(4) Refill or replenish oil as necessary (Ref. 24-11-01).

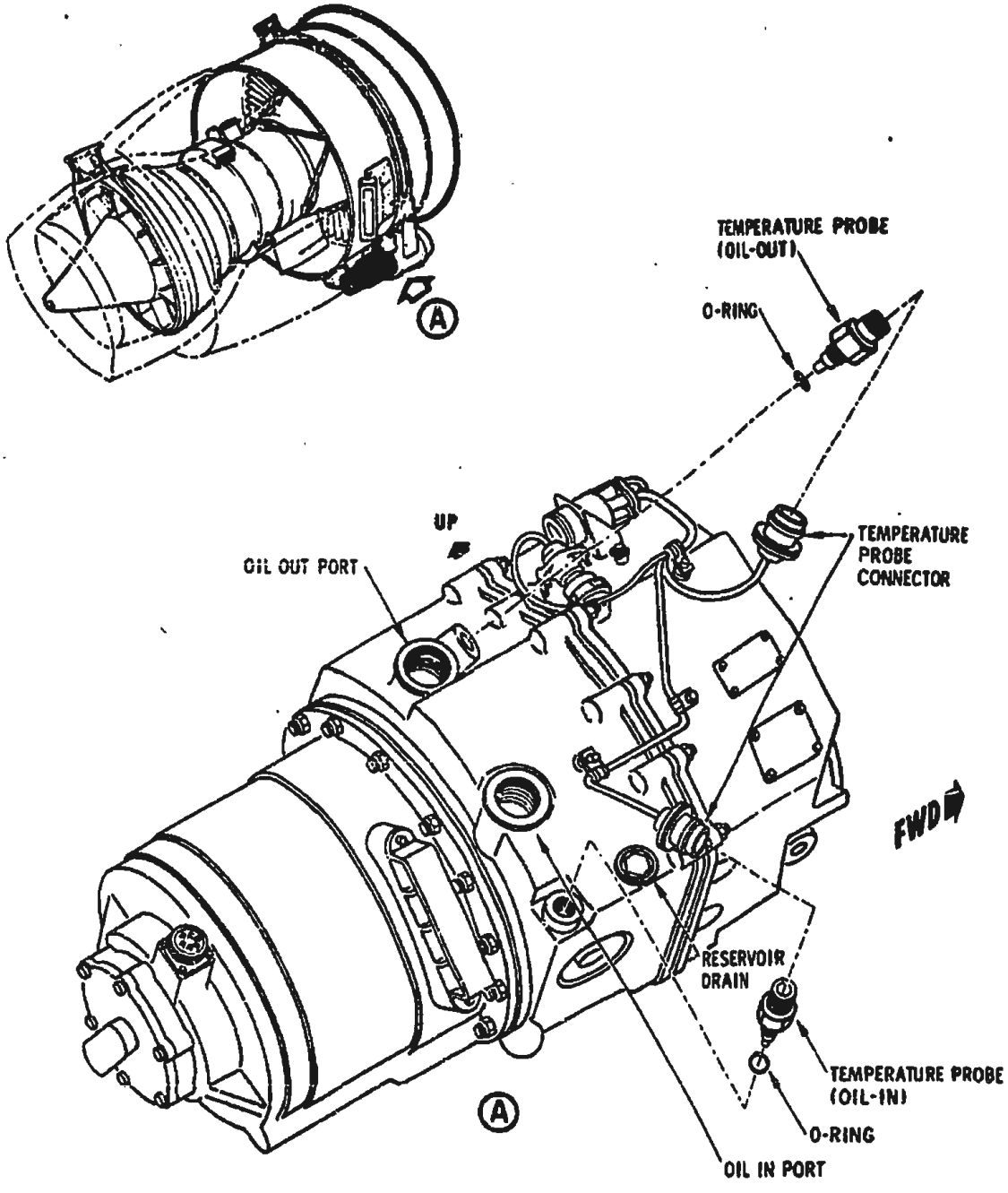
(5) On aircraft without SB24-082, tighten gravity fill plug, torque 10 to 12 lb ft., and lock-wire.

NOTE: On aircraft with SB24-082, the push to vent valve automatically seals the IDG.

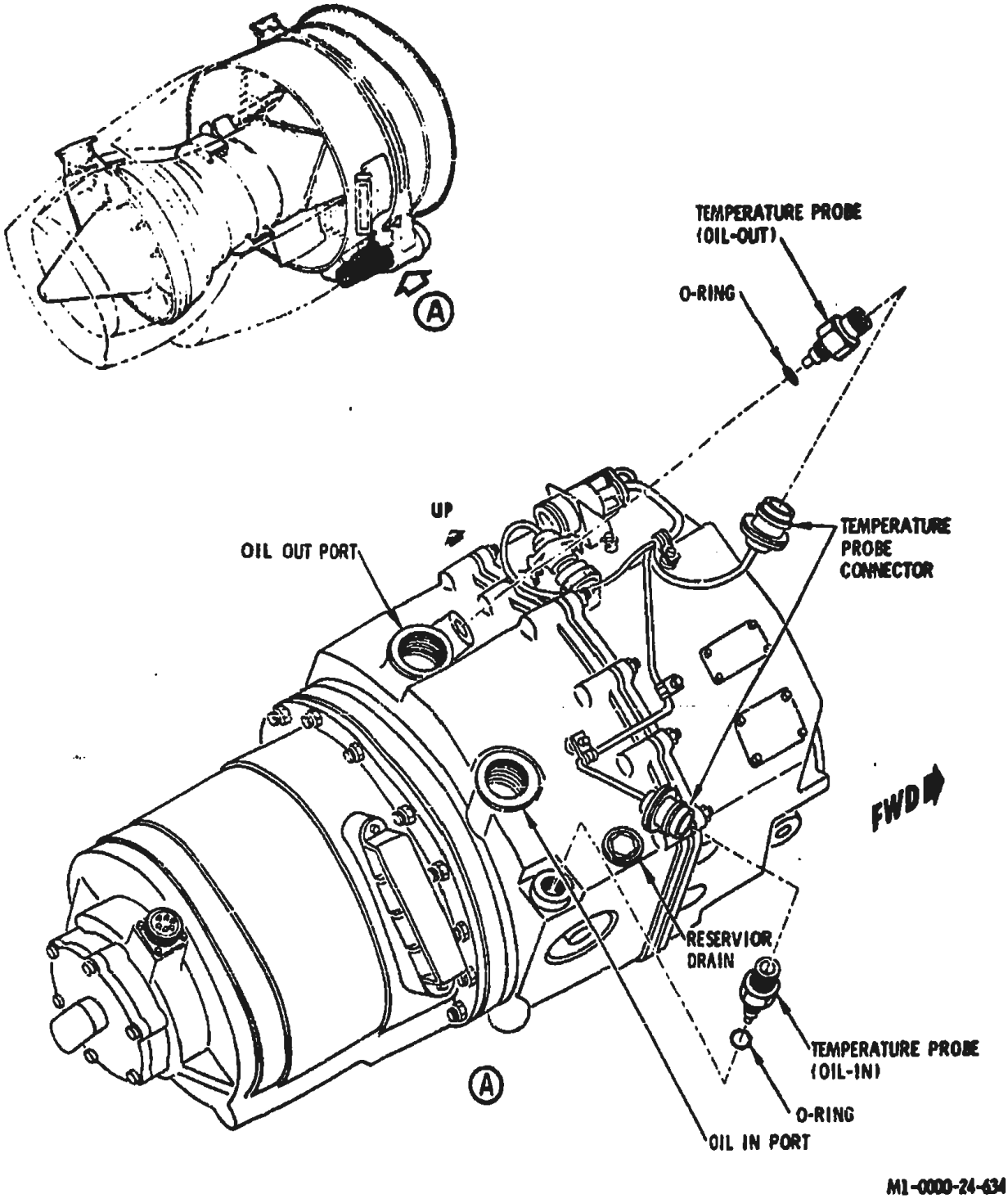
(6) Motor engine for 2 minutes (Ref. 71-00-00) and check for oil leaks. Repair leaks and recheck.

(7) Close and secure cowl panels.

(8) On next engine run, verify proper operation of temperature probe by observing corresponding IDG OIL TEMP indicator on Flight Engineer/Second Officers electrical control panel, zone 215.



IDG Oil Temperature Probes - Removal and Installation
Figure 401



IDG Oil Temperature Probes - Removal and Installation
Figure 401

INTEGRATED DRIVE GENERATOR (IDG) TRANSMISSION CHARGE AND UNDERSPEED PRESSURE SWITCHES REMOVAL AND INSTALLATION

1. Equipment and Materials

O-rings (Ref. Fig. 401)

Lubricant, Acryloid, Rohm and Haas, HF825, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-11-01	IDG Assembly - Servicing
71-00-00	Power Plant - Adjustment and test
71-11-00	Cowling Engines No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 Cowling - General Servicing

3. Removal/Installation

A. Removal

(1) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

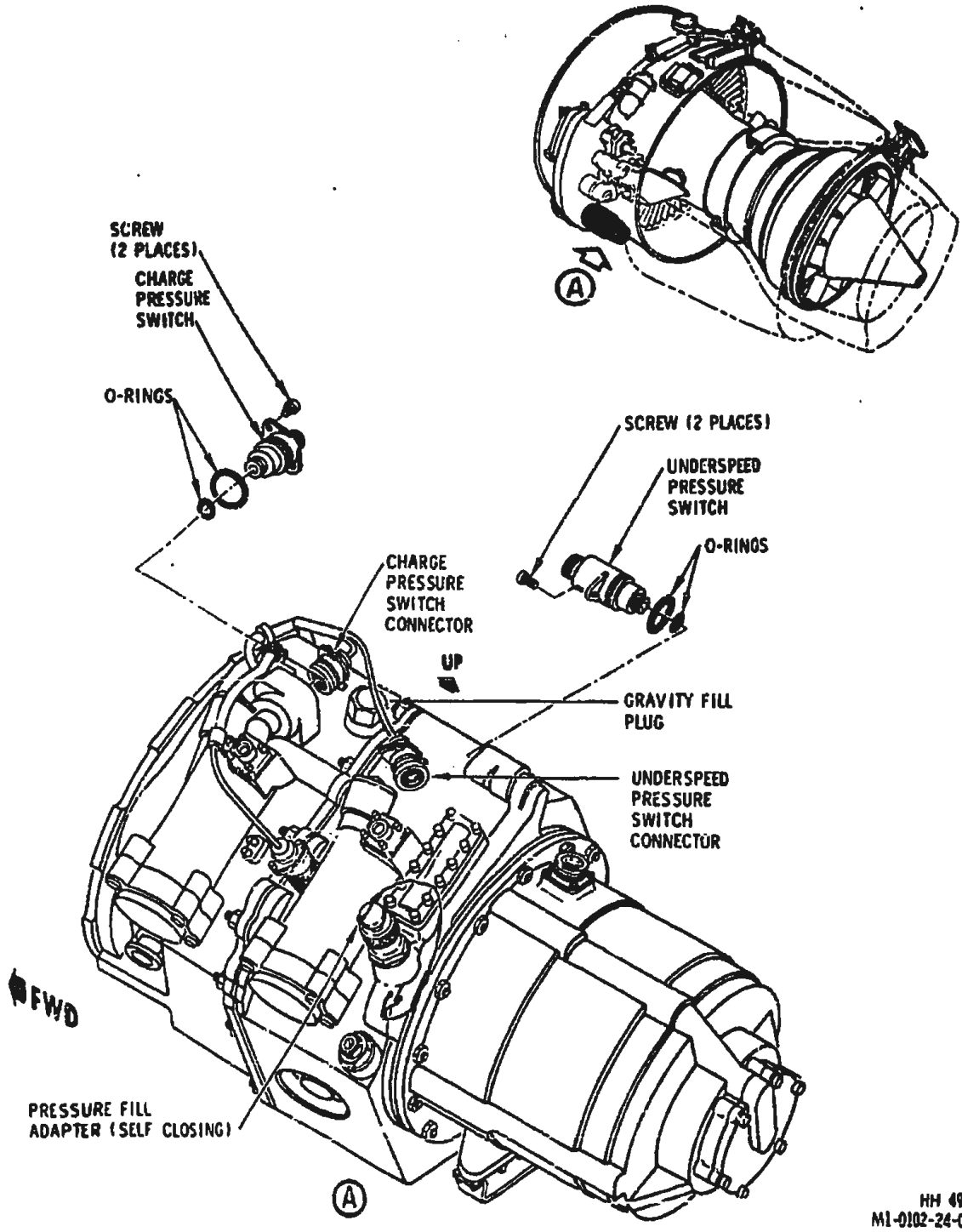
(2) On aircraft without SB-24-082, loosen gravity fill plug to relieve internal pressure (Ref. Fig. 401).

R WARNING: PUSHING THE VENT RELIEF VALVE MAY CAUSE SOME OIL
R TO SPRAY OUT OF VENT. AFTER PUSHING THE PRESSURE
R RELIEF VALVE, PERSONNEL SHOULD STAND BACK A SAFE
R DISTANCE.

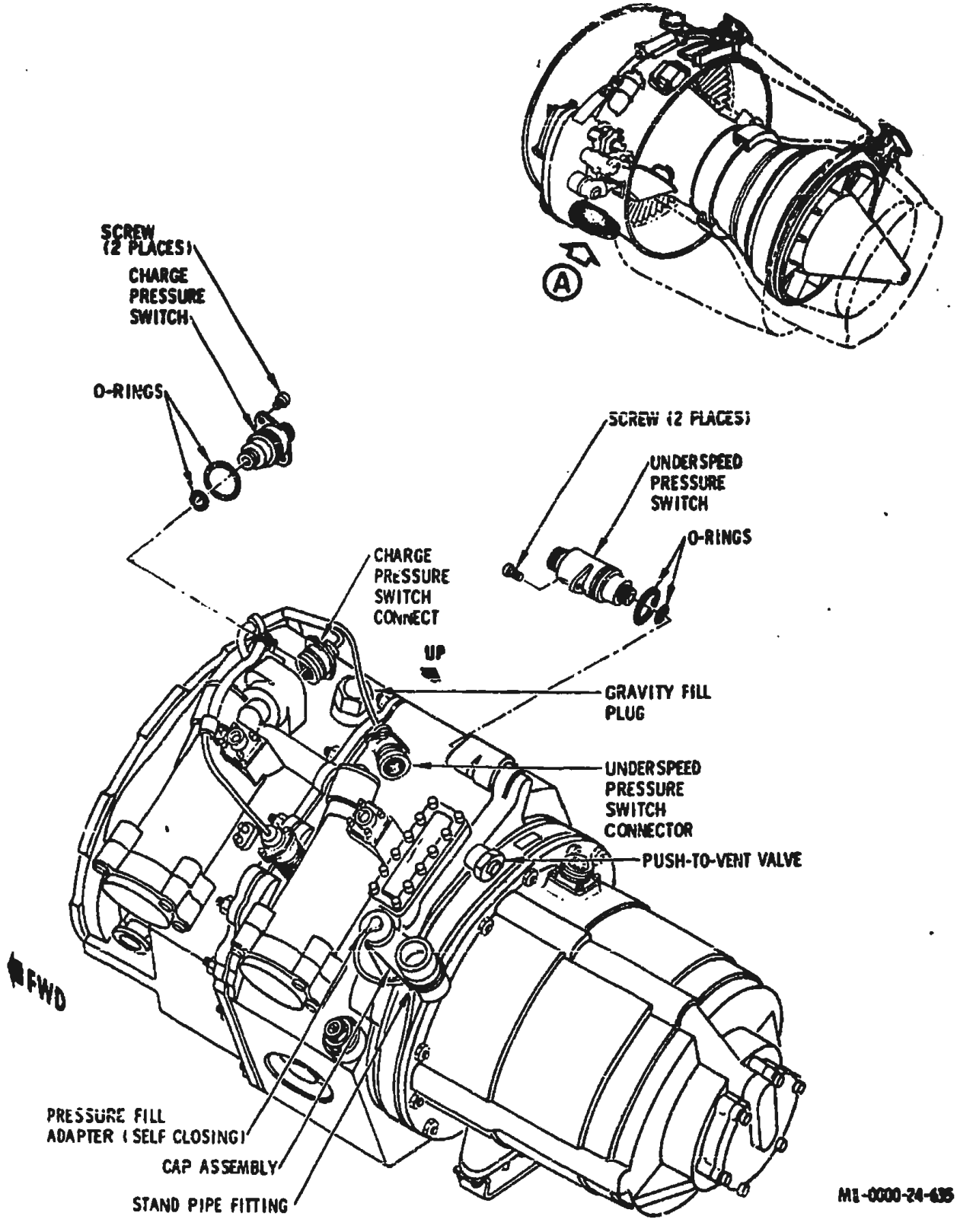
(2) On aircraft with SB-24-082, press push-to-vent valve to relieve internal pressure (Ref. Fig. 401).

CAUTION: WHEN WORKING ON IDG OIL SYSTEM USE EXTREME CARE TO KEEP SYSTEM CLEAN. KEEP SYSTEM CLEAN.

(3) Remove electrical connector from switch to be removed.



IDG Transmission Charge and Underspeed Pressure Switches
Removal and Installation
Figure 401



R IDG Charge and Underspeed Pressure Switches
R Removal and Installation
R Figure 401

EFFECTIVITY: WITH SB24-082, SUNSTRAND 24-1441, 24-1443

001B

WARNING: TAKE PRECAUTIONARY MEASURES WHEN REMOVING COMPONENTS. OIL (IF HOT) CAN CAUSE INJURY.

(4) Remove screws and pressure switch assembly.

(5) Remove and discard O-rings.

B. Installation

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL TRANSMISSION O-RINGS.

(1) Install new O-rings into grooves on pressure switch assembly.

(2) Install pressure switch assembly.

(3) Install screws and torque 20 to 22 lb in.

NOTE: One of the charge pressure switch attaching screws also secures a wiring harness loop clamp. Be certain clamp is secured before tightening screw.

(4) Connect wiring harness connector to switch and lock-wire.

(5) Check oil level and replenish as necessary (Ref. 24-11-01).

(6) On aircraft without SB24-082, tighten gravity fill plug, torque 10 to 12 lb ft. and lock wire.

NOTE: On aircraft with SB24-082, push-to-vent valve automatically seals IDG.

R (7) Motor engine for 2 minutes (Ref. 71-00-00) and check for oil leaks. Repair leaks and recheck.

(8) Close and secure cowl panels.

R (9) On ext engine run, verify proper operation of newly installed charge or underspeed pressure switch by observing the following indications on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215:

(a) To check operation of charge pressure switch, verify that IDG DISCONNECT LOW PRESS switchlight goes off when engine is started.

(b) To check operation of underspeed pressure switch, verify that flowbar indication in the GENERATOR FIELD CLOSE switchlight comes on and the corresponding OPEN switchlight goes off at approximately 51 percent N3 rpm.

OIL LEVEL SIGHT GLASS - REMOVAL AND INSTALLATION

1. Equipment and Materials

Sight glass gaskets, Sundstrand Aviation, or equivalent (Ref. Fig. 401)

O-ring (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Lubricant, Acryloid, Rohm and Hass, HF825, or equivalent

Container (10 quart, minimum)

Compound, Dow Corning, Type 4

2. Referenced Procedures

24-11-01	IDG Assembly - Servicing
71-00-00	Power Plant - Adjustment and Test
71-11-00	Cowling Engines No. 1 and No. 3 - General Servicing
71-12-00	Engine No. 2 Cowling - General Servicing
24-21-01	IDG Assembly - Removal and Installation

3. Removal/Installation

A. Removal

(1) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

(2) On aircraft without SB24-082, loosen gravity fill plug to relieve pressure (Ref. Fig. 401).

R WARNING: PUSHING THE VENT RELIEF VALVE MAY CAUSE SOME OIL
R TO SPRAY OUT OF VENT. AFTER PUSHING THE PRESSURE
R RELIEF VALVE, PERSONNEL SHOULD STAND BACK A SAFE
R DISTANCE.

(2) On aircraft with SB24-082, press push-to-vent valve to relieve internal pressure (Ref. Fig. 401).

CAUTION: WHEN WORKING ON IDG TRANSMISSION OIL SYSTEM USE EXTREME CARE TO KEEP THE SYSTEM CLEAN.

(3) Position container under reservoir, remove reservoir drain plug, and drain oil.

(4) Remove screws and oil level indicator plate.

(5) Remove and discard gasket.

CAUTION: ENSURE THAT SIGHT GLASS IS NOT BROKEN. IF GLASS IS BROKEN, ENSURE THAT NO GLASS ENTERS OR HAS ENTERED THE TRANSMISSION. ALL BROKEN GLASS MUST BE REMOVED. IF SYSTEM IS SUSPECTED OF BEING CONTAMINATED, REMOVE INTEGRATED DRIVE GENERATOR (REF. 24-11-01) AND SEND TO OVERHAUL.

(6) Remove sight glass.

(7) Remove and discard sight glass gasket.

B. Installation

(1) Apply a thin coat of Dow Corning type 4 compound on a new sight glass gasket (Ref. Fig. 401) and place the gasket in the recess in the transmission housing.

(2) Install the sight glass. Place a new gasket and the oil level indicator plate over the sight glass.

(3) Lubricate mounting screws with oil; install and tighten screws in proper sequence (Ref. Fig. 401). First torque 4 to 5 lb in. then retorque at 7 to 9 lb in.

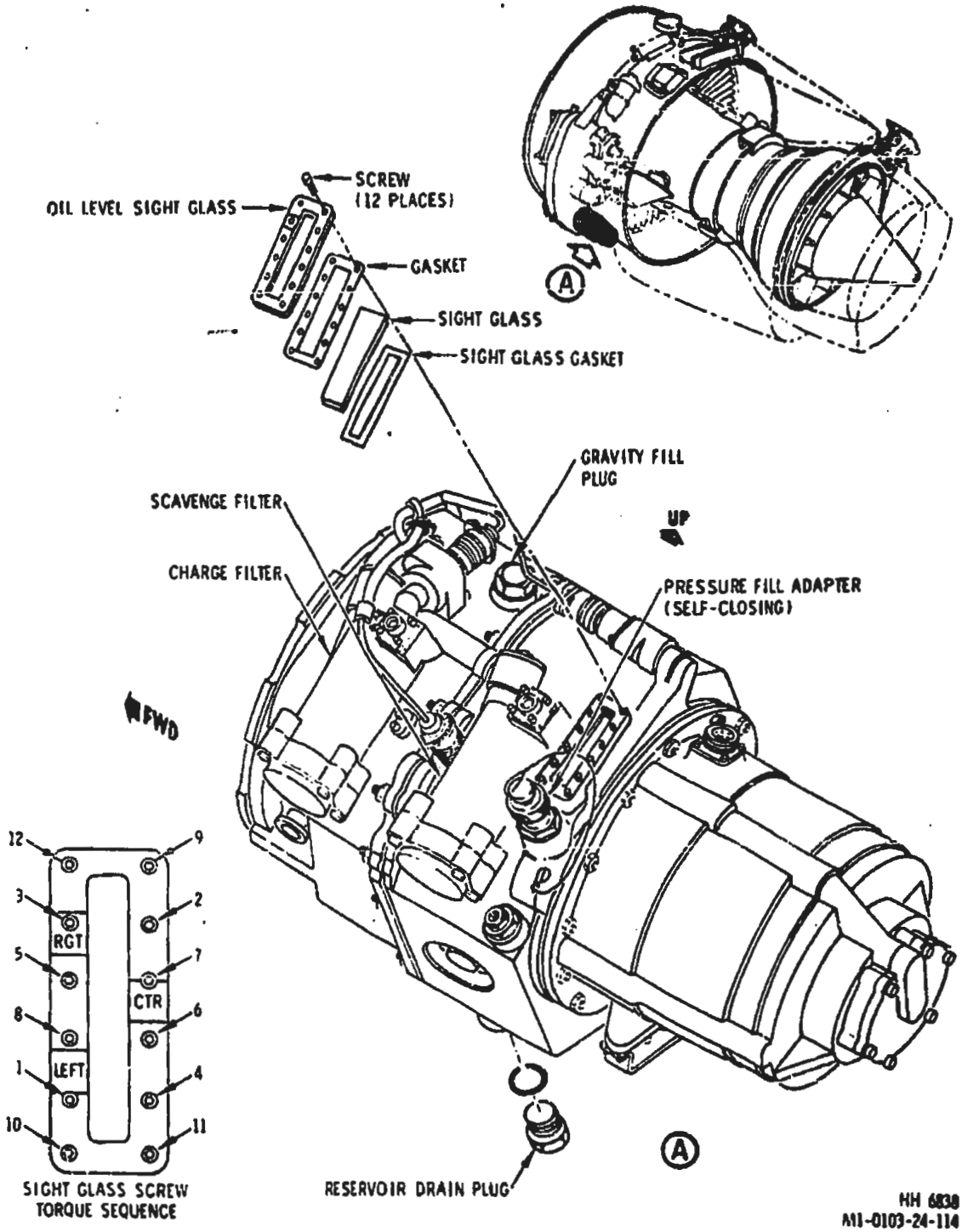
(4) Fit a new O-ring on reservoir drain plug, install plug in case, torque 40 to 55 lb. in. and lock-wire.

(5) Refill transmission (Ref. 24-11-01).

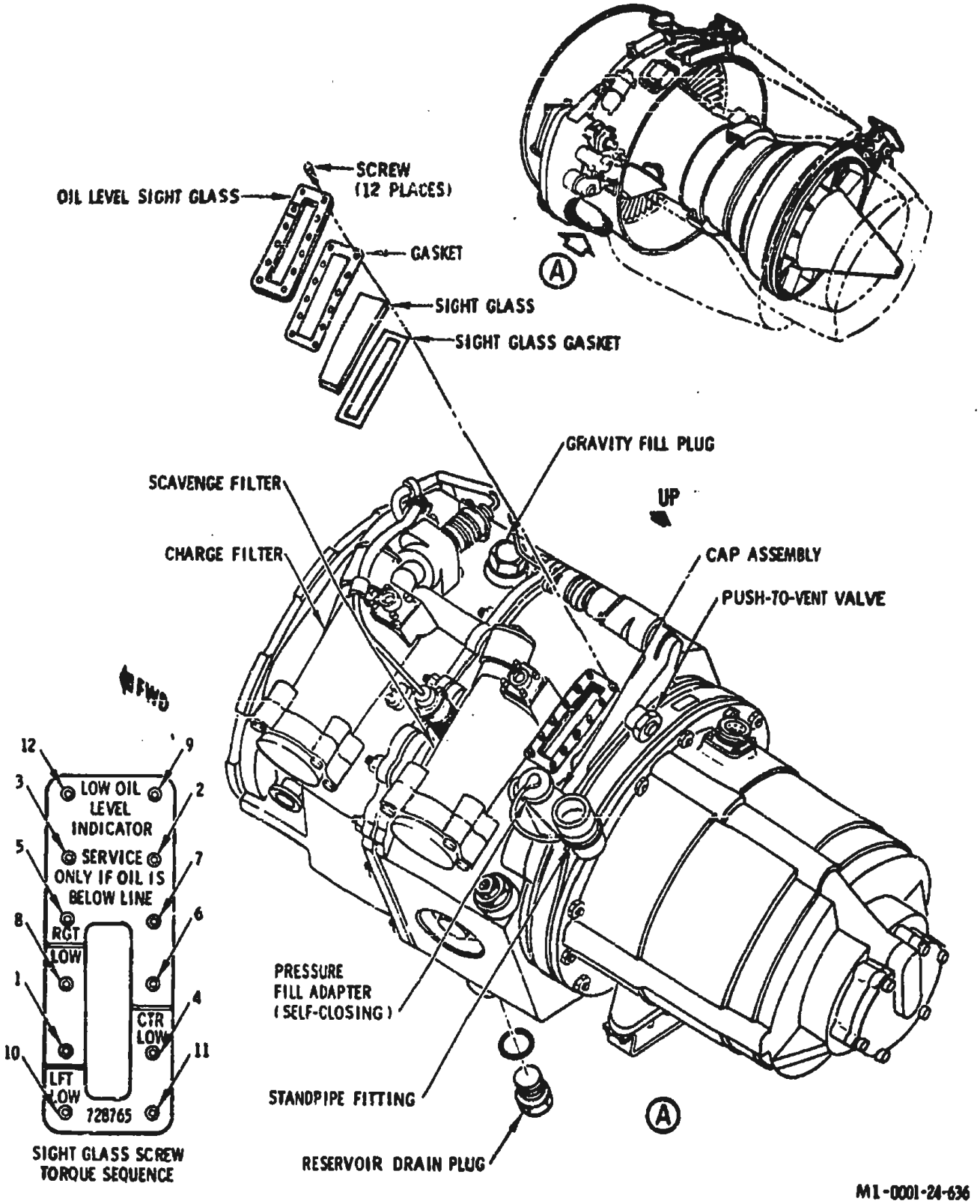
(6) On aircraft without SB24-082, torque gravity fill plug 10 to 12 lb ft and lock-wire.

(6) On aircraft with SB24-082, replace cap assembly.

(7) Motor engine for 2 minutes (Ref. 71-00-00) and check for oil leaks. Repair leaks and recheck.



Oil Level Sight Glass - Removal and Installation
Figure 401



Oil Level Sight Glass - Removal and Installation
Figure 401

(8) Close and secure cowl panels.

R OIL COOLER AND OIL COOLER BY-PASS VALVE - REMOVAL AND INSTALLATION

R 1. General

R WARNING: THE SYNTHETIC LUBRICATING OIL USED IN THIS SYSTEM MAY CAUSE IRRITATION IF SKIN CONTACT IS REPEATED OR PROLONGED.

R CAUTION: (1) THE OIL SPECIFIED FOR USE IN THIS OIL SYSTEM IS INJURIOUS TO PAINT WORK AND CERTAIN TYPES OF RUBBER AND MUST NOT BE ALLOWED TO CONTAMINATE THOSE PARTS OF THE ENGINE NOT NORMALLY IN CONTACT WITH IT. ANY OIL SPILT DURING SERVICING MUST BE WIPED UP IMMEDIATELY.

R (2) THE COMBINED WEIGHT OF THE INTEGRATED DRIVE GENERATOR (I.D.G.) TRANSMISSION OIL COOLER AND DIFFUSER DUCT IS APPROXIMATELY 22 LB. (10 KG.).

R 2. Service Bulletin reference

R S.B.78-5093 - Integrated Drive Generator (I.D.G.) Outlet Duct with Increased Exit Area

R 3. Referenced Procedures

R 24-21-01 I.D.G. Oil Cooler - Servicing.

R 70-02-01 Identification, Lubrication and Fitting of Rubber Sealing Rings.

R 70-51-00 Torque Tightening Techniques.

R 71-11-00 Cowlings, Engines No. 1 and 3 - Servicing.

R 71-12-01 L.H. and R.H. Lower Hinged Cowl - Servicing.

R 4. Illustrated Parts Catalog References

R The I.P.C. sections where parts disturbed during the following operations can be located are as follows:

R 24-11-08 I.D.G. Oil Cooler Brackets.

R 24-11-09 I.D.G. Oil Tubes and Fittings.

R 5. Removal/Installation - Oil Cooler

R A. Removal

R (1) Equipment required:

R UT.818 Spanner wrench

R Clean receptacle - minimum capacity

R 2 U.S. pints

R 2 Imperial pints

R 1.5 Litres

R (2) Open right-hand hinged cowl 414A or 424A for engines
R No. 1 and 3 (Ref. 71-11-00) or 434AR for engine No. 2
R (Ref. 71-12-01).

R (3) Refer to Fig. 401, remove outlet duct (1).

R (a) Remove bolt, nut and washer securing left-hand
R duct support link (4) and bolt, nut and washer
R securing right-hand duct support link (5).

R (b) Remove duct to firewall connecting screw (4 off)
R and screw and washer (4 off), then remove duct
R from engine.

R (4) Remove brackets (2) and (3).

R (a) Remove bolt (2 off), plain washer (2 off), spacer
R (4 off) and inner and outer bracket assemblies
R from left-hand bracket (2).

R (b) Remove bolt (2 off), plain washer (2 off), spacer
R (4 off) and inner and outer bracket assemblies
R from right-hand bracket (3).

R (c) Remove bolt (4 off), washer (4 off) attaching
R brackets to fan case, remove brackets.

R (5) Refer to Fig. 402, remove bolts, washers and nuts (1),
R (2) and (3).

R (6) Disconnect connectors (4) and (5), and using spanner
R wrench UT.818, disconnect connectors (6) and (7), then
R remove oil tubes.

R (7) Release quick release fasteners (8) and (9).

R (8) Remove bolts and washers securing engine control clips
R to brackets (10) and (11).

R (9) Remove retaining rings, covers, bolts and washers (12).

R CAUTION: THE COMBINED WEIGHT OF IDG OIL COOLER AND DIFFUSER
R DUCT IS APPROXIMATELY 22 POUNDS.

R (10) Note position of clipping and support brackets on
R diffuser duct, then support cooler and duct and remove
R bolts, washers (13), and brackets. Carefully remove
R cooler and duct from low pressure compressor case.
R Drain cooler contents into container. Place cooler and
R duct on work bench.

R (11) Note position of clipping brackets on diffuser duct
R mating flange, then remove bolts, washers, nuts (14)
R and (15), and brackets. Separate oil cooler from
R diffuser duct.

R (12) Fit approved blanks to all exposed apertures and
R connectors.

R B. Installation

R (1) Equipment required:

R UT.818 Spanner wrench

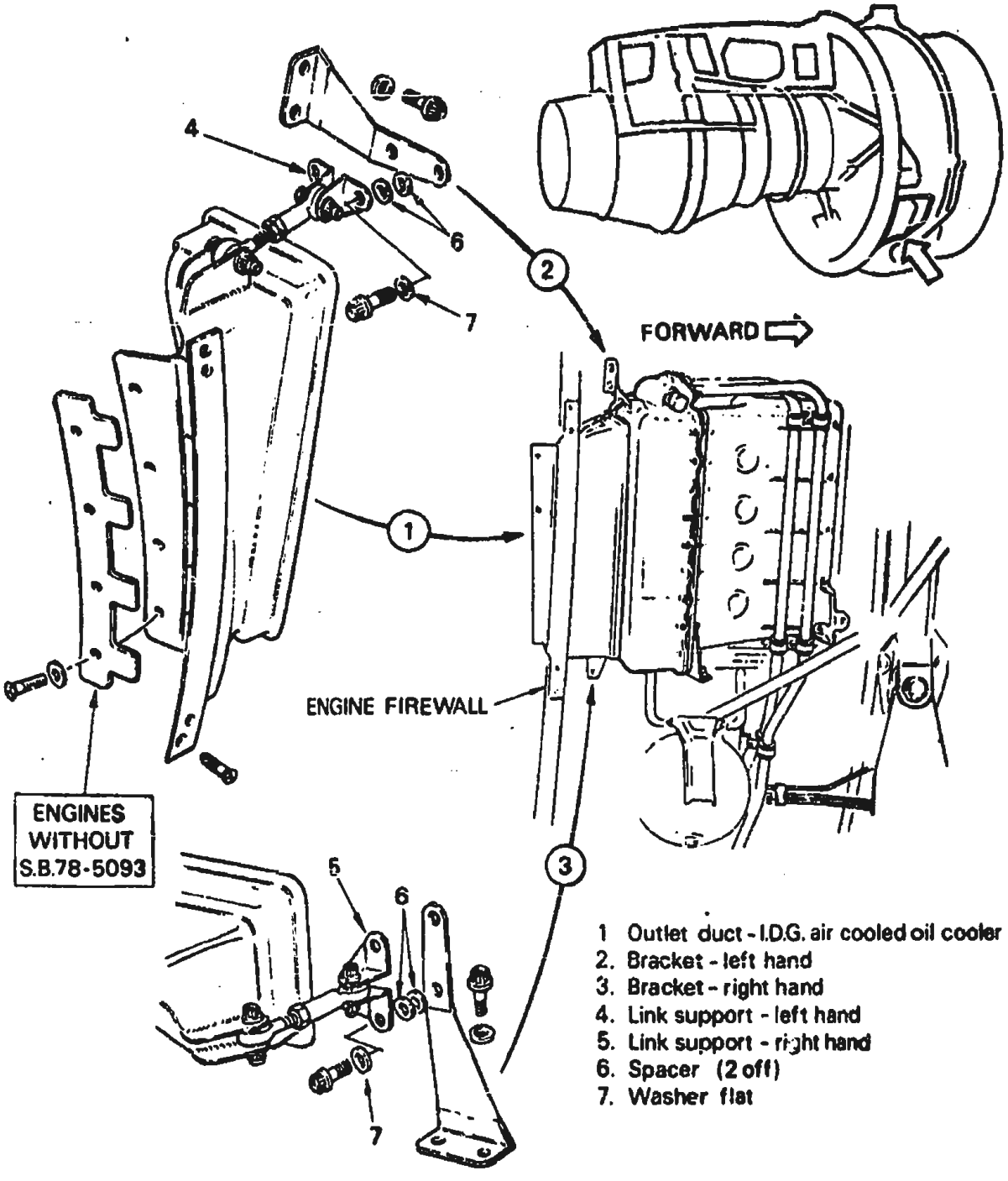
R HU.20604 I.D.G. Alignment tool

R Clean, stiff-bristled brush

R (2) Material required:

R		British Spec./Ref.	American Spec./Ref.	OMat Item-No.
R	Jointing compound	DTD.900/4586 (Hylomar light)		426A
R	Degreasing fluid (Inhibited 1.1.1. Trichloroethane)	B.S.4487: 1969	MIL-T-81533A	1/21

R (3) Remove blanks, if fitted, from all apertures and
R connectors.



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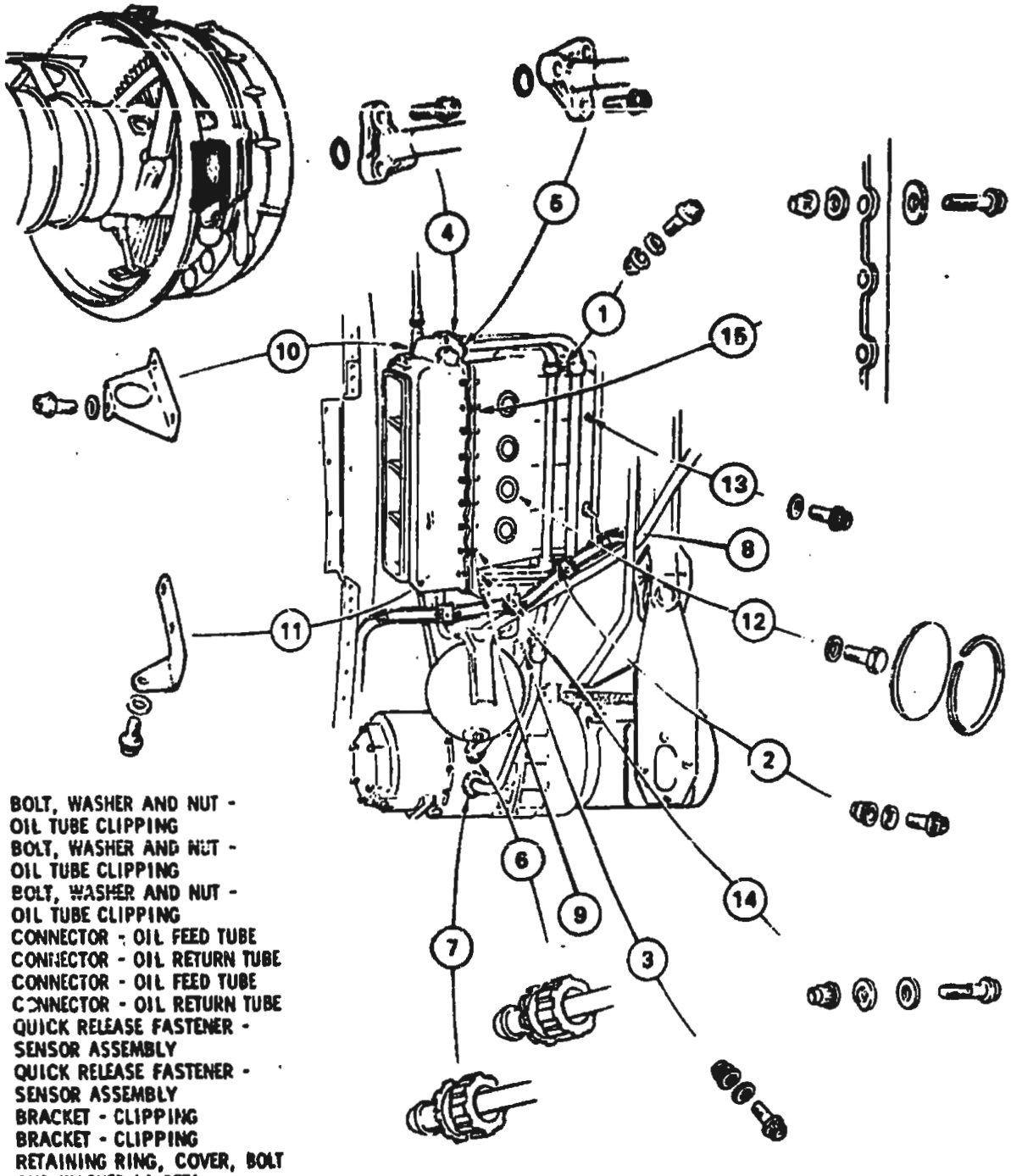
R IDG Oil Cooler Outlet Duct and Support Brackets - Removal and
R Installation
R Figure 401



1 BOLT, WASHER AND NUT - OIL TUBE CLIPPING
2 BOLT, WASHER AND NUT - OIL TUBE CLIPPING
3 BOLT, WASHER AND NUT - OIL TUBE CLIPPING
4 CONNECTOR - OIL FEED TUBE
5 CONNECTOR - OIL RETURN TUBE
6 CONNECTOR - OIL FEED TUBE
7 CONNECTOR - OIL RETURN TUBE
8 QUICK RELEASE FASTENER - SENSOR ASSEMBLY
9 QUICK RELEASE FASTENER - SENSOR ASSEMBLY
10 BRACKET - CLIPPING
11 BRACKET - CLIPPING
12 RETAINING RING, COVER, BOLT AND WASHER (4 OFF)
13 BOLT (11 OFF) AND WASHER (5 OFF)
14 BOLT, WASHERS AND NUT (2 OFF)
15 BOLT, WASHERS AND NUT (16 OFF)

MI-0001-24-181

R
R

Oil Cooler Disconnect Points
Figure 402

EFFECTIVITY: ALL

001B

R WARNING: WHEN USING DEGREASING FLUID AVOID SKIN CONTACT AND
R INHALING THE VAPOUR.

R Using degreasing fluid, remove all traces of old jointing compound from diffuser duct mating faces and L.P. compressor case mounting face. Also clean mating face of oil cooler.

CAUTION: ENSURE JOINTING COMPOUND DOES NOT ENTER AIR OR OIL PASSAGES.

Using brush, apply thin film of jointing compound to diffuser duct and oil cooler mating faces; allow compound to dry for a minimum period of 10 minutes.

(4) Refer to Fig. 402. On work surface, position oil cooler on diffuser duct so that holes in cooler mating face are in center of slots in diffuser duct mating face. Correctly position clipping brackets, as noted in operation A.(11), then fit and secure bolts, washers and nuts (14) and (15).

CAUTION: ENSURE JOINTING COMPOUND DOES NOT ENTER AIR PASSAGES.

Using brush, apply thin film of jointing compound to diffuser duct and L.P. compressor case mating faces; allow compound to dry for a minimum period of 10 minutes.

(5) Position oil cooler and diffuser duct on L.P. compressor case mounting face ensuring positive dowel location. Correctly position clipping and support brackets on diffuser duct, as noted in operation A.(10), then fit and secure bolts and washers (13). Washers are not fitted to bolts that also secure brackets.

(6) Fit and secure washers, bolts, covers and retaining rings (12).

(7) Using I.D.G. alignment tool, check oil cooler alignment.

(8) Fit and secure bolts and washers securing engine control clips to brackets (11) and (10).

(9) Secure and lock quick release fasteners (9) and (8).

(10) Using spanner wrench UT.818, connect and tighten (Ref. 70-51-00) connectors (7) and (6).

R (11) Fit and lubricate (Ref. 70-02-01) new seal rings then
R connect and secure connectors (5) and (4).

R (12) Fit and secure bolts, washers and nuts (3), (2) and
R (1).

R (13) Refer to Fig. 401, fit and secure brackets (3) and (2).

R (a) Fit and secure brackets with washer (4 off) and
R bolt (4 off) to fan case.

R (b) Fit inner and outer bracket assemblies complete
R with spacer (4 off), washer (2 off), bolt (2 off)
R to left and right-hand support brackets.

R (14) Fit and secure outlet duct (1).

R (a) Position and secure outlet duct to firewall
R assembly.

R (b) Fit duct support links (4) and (5) to left and
R right-hand support brackets adjust as necessary,
R secure with bolt, nut and washer.

R (15) Replenish I.D.G. transmission oil system as required
R (Ref. 24-21-01).

R NOTE: Replacement of I.D.G. transmission oil cooler incurs
R a loss of 2 pints (approximately) of oil from I.D.G.
R transmission oil system.

R (16) Close right-hand hinged cowl 414A or 424A for engines
R No. 1 and 3 (Ref. 71-11-00) or 434AR for engine No. 2
R (Ref. 71-12-01).

R 6. General

R WARNING: THE SYNTHETIC LUBRICATING OIL USED IN THIS SYSTEM MAY
R CAUSE IRRITATION IF SKIN CONTACT IS REPEATED OR
R PROLONGED.

R CAUTION: THE OIL SPECIFIED FOR USE IN THIS OIL SYSTEM IS
R INJURIOUS TO PAINT WORK AND CERTAIN TYPES OF RUBBER
R AND MUST NOT BE ALLOWED TO CONTAMINATE THOSE PARTS OF
R THE ENGINE NOT NORMALLY IN CONTACT WITH IT.

R ANY OIL SPILT DURING SERVICING MUST BE WIPED UP
R IMMEDIATELY.

R 7. Referenced Procedures

R	70-02-01	Identification, Lubrication and Fitting of Rubber Sealing Rings.
R	71-11-00	Cowlings, Engines No. 1 and No. 3 - Servicing.
R	71-12-01	L.H. and R.H. Lower Hinged Cowl - Servicing.

R 8. Illustrated Parts Catalog

R The I.P.C. sections where parts disturbed during the following
R operations can be located are as follows:

R	24-11-08	Integrated Drive Generator Oil Cooler

R 9. Removal/Installation Oil Cooler By-Pass Valve

A. Removal

(1) Open right-hand hinged cowl 414A or 424A for engines No. 1 and 3 (Ref. 71-11-00) or 434AR for engine No. 2 (Ref. 71-12-01).

(2) Refer to Fig. 403, remove valve assembly (1) from oil cooler (3).

(3) Remove sealing ring (2) from valve assembly.

(4) Fit approved blank to valve apertures.

B. Installation

R (1) Material required:

R	British Spec./Ref.	American Spec./Ref.	OMat Item No.
R Lockwire	DTD.189A 22 S.W.G.		238
R		21 A.W.G.	
R Silicone grease	DTD.897A (Molykote 33)		

R CAUTION: DO NOT CLEAN VALVE WITH TRICHLOROETHANE LIQUID OR
R VAPOUR.

R Check valve is clean and if necessary thoroughly wash
R valve using a low-pressure kerosine spray. Allow to
R drain and dry with a clean lint-free cloth.

R (2) Remove blank from valve aperture.

R (3) Refer to Fig. 403. Lubricate sealing ring (2) with
R silicone grease.

R (4) Fit sealing ring to valve assembly (1) (Ref. 70-02-01).

R (5) Fit valve assembly to oil cooler (3) then wirelock.

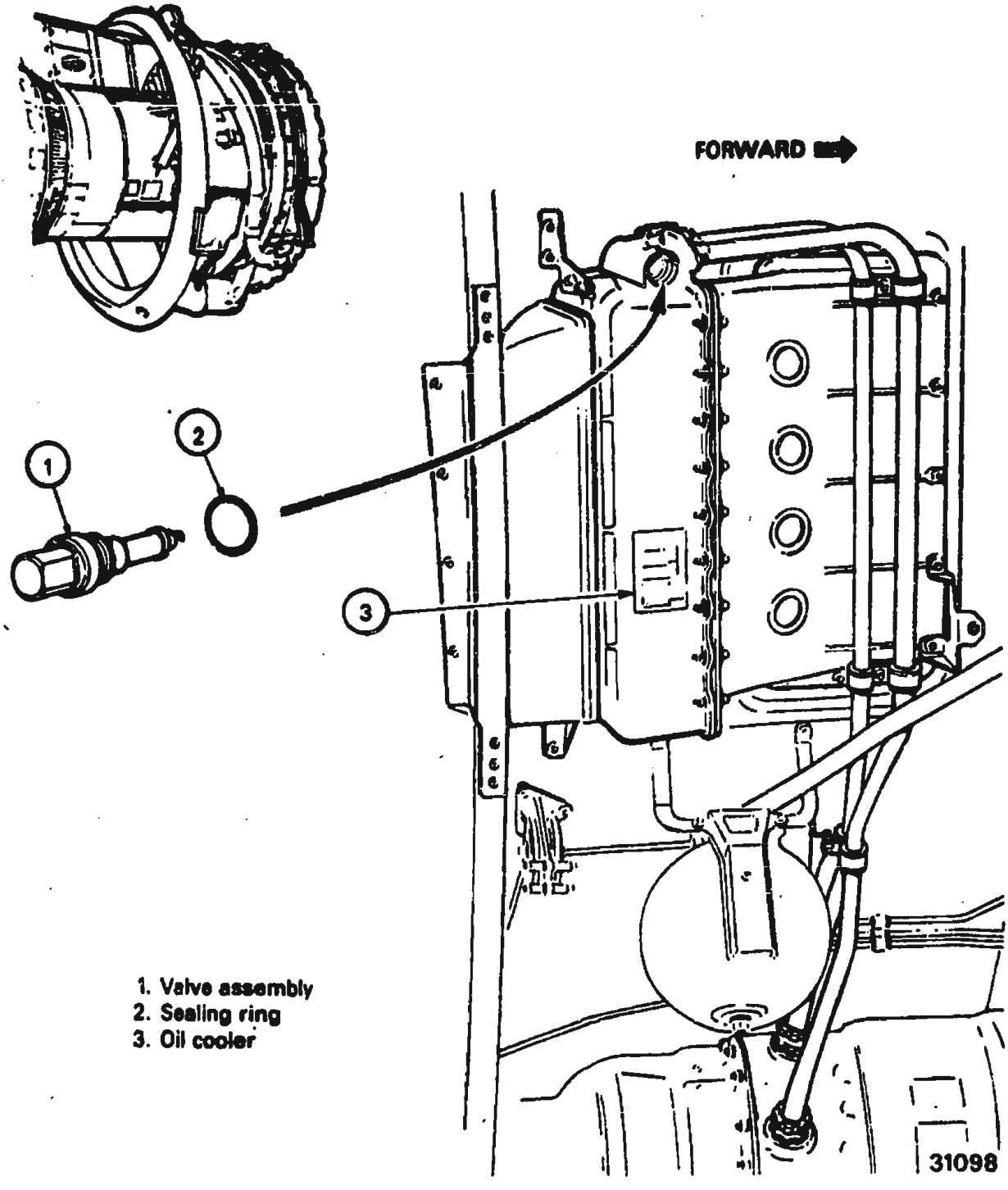
R (6) Close right-hand hinged cowl 414A or 424A for engines
R No. 1 and 3 (Ref. 71-11-00) or 434AR for engine No. 2
R (Ref. 71-12-01).

R 10. Inspection/Check Oil Cooler By-Pass Valve

R A. Check By-Pass Valve

R (1) Check valve face for damage.

R (2) Check spring-loaded valve sleeve for freedom of
R movement.



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R R Oil Cooler Bypass Valve - Removal and Installation
Figure 403

R R 001B EFFECTIVITY: ALL

IDG OIL TEMPERATURE INDICATOR - ADJUSTMENT AND TEST

1. General

This built-in test equipment (BITE) test procedure is performed to determine if the circuitry within the indicator is operating normally.

2. Referenced Procedures

24-00-00 Electrical Power - Maintenance Practices

24-00-05 Flight Engineer/Second Officers Electrical Control Panel - Removal and Installation

3. Adjustment/Test

A. BITE Test

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker IDG OIL TEMP is closed.

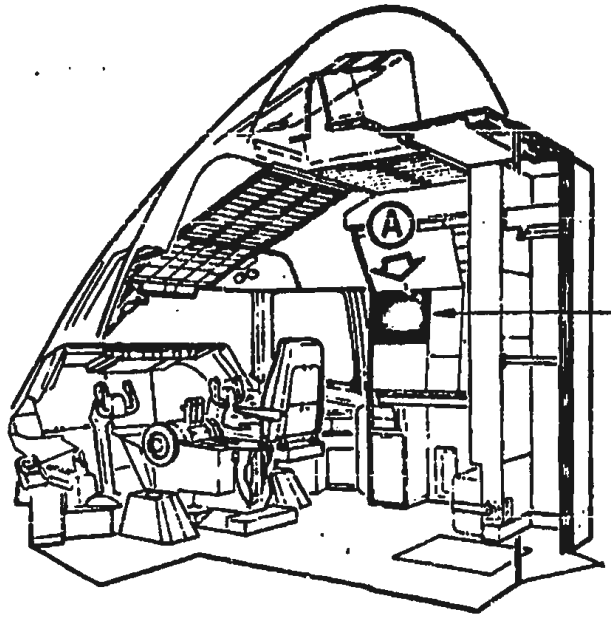
R R R (2) On Flight Engineer/Second Officers Electrical Control panel (Ref. Fig. 501), release panel fasteners and slide panel inboard until stops are engaged (Ref. 24-00-05).

(3) Turn on aircraft electrical system (Ref. 24-00-00).

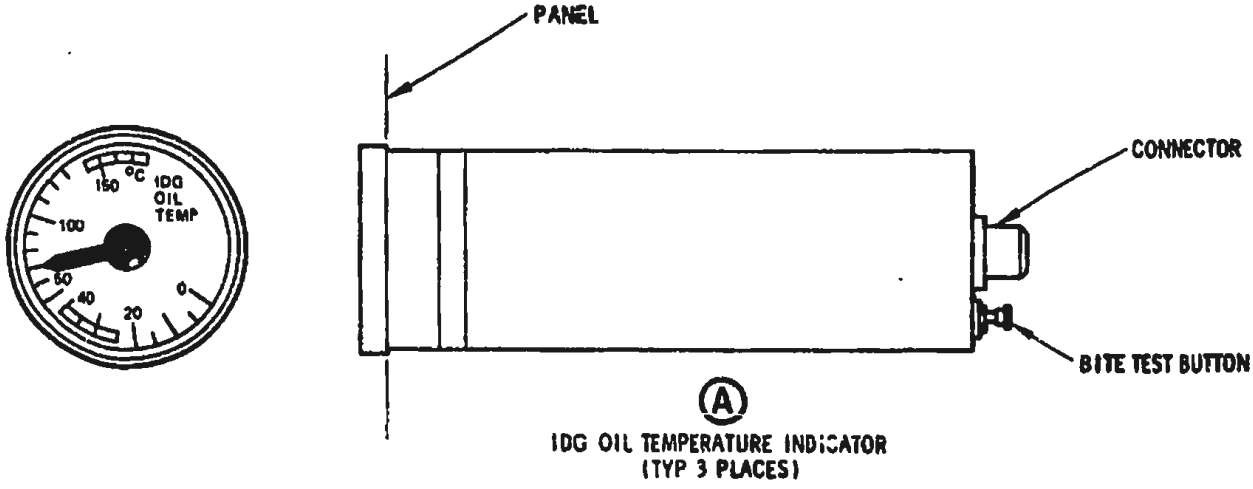
(4) Press BITE test button on connector end of IDG oil temperature indicator and verify that indicator reads R 120 (±3.6) degrees centigrade (Ref. Fig. 501).

(5) Turn off aircraft electrical system (Ref. 24-00-00).

(6) Close and secure ELECTRICAL panel (Ref. 24-00-05).



ZONE 215



IDG OIL TEMPERATURE INDICATOR
(TYP 3 PLACES)

M1-0000-24-1153

R IDG Oil Temperature Indicator BITE Test Button
R Figure 501

R EFFECTIVITY: ALL
R
001B

REAL LOAD DIVISION CONTROLLER - REMOVAL AND INSTALLATION

1. General

Three real load division controllers, one for each IDG, are mounted on the forward bulkhead of the mid electrical service
R center, zone 137.

The controllers are solid-state devices which control the IDG transmissions so that the real loads will be evenly divided between paralleled generators.

The controllers are identical and interchangeable and cannot be installed incorrectly, therefore, no special precautions are necessary when installing these units.

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker corresponding to controller to be removed: LOAD CONT & BUS FAIL IND - BUS 1, BUS 2, or BUS 3 (D10, D13, or D16).

(2) Remove electrical connector from end of controller (Ref. Fig. 401).

(3) Remove mounting screws from base of controller and remove controller.

B. Installation

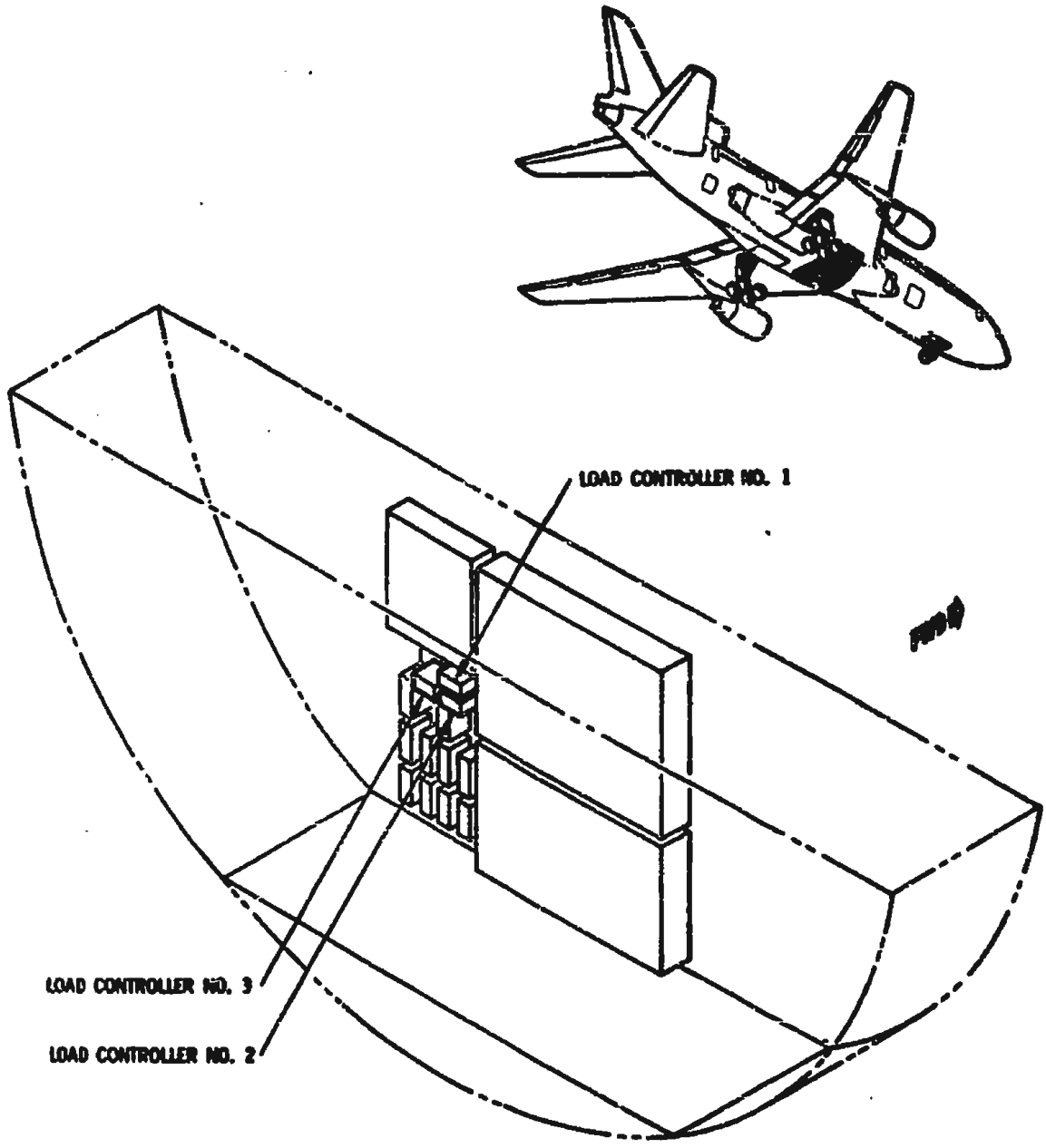
(1) Verify that circuit breaker opened in Step 1A(1) is opened and tagged.

(2) Place controller in proper position and install mounting screws.

(3) Install electrical connector on controller.

(4) Close circuit breaker opened in Step 1A(1).

(5) On next engine run, verify that engine corresponding to new load controller properly parallels with another operating generator.



R
R Load Controller Locations
Figure 401

R EFFECTIVITY: ALL
R
001B

QUICK ATTACH-DETACH (QAD) ADAPTER KIT - REMOVAL AND INSTALLATION

1. Equipment and Materials

Gasket (2), Sundstrand Aviation (Ref. Fig. 401)

O-ring, Sundstrand Aviation (Ref. Fig. 401)

Acryloid, Rohm and Haas, or equivalent

2. Removal/Installation

A. Removal

(1) Remove mounting screws.

(2) Pull QAD away from accessory pad. Tap with soft-faced mallet if QAD sticks to pad.

(3) Remove gasket and O-ring. Clean any stuck gasket material from accessory pad.

B. Installation

(1) Check that accessory pad is clean and that all attachment screw hole threads are undamaged.

(2) Place new gasket on engine side of QAD adapter plate.

(3) Lubricate new O-ring with Acryloid and install on flange of adapter plate.

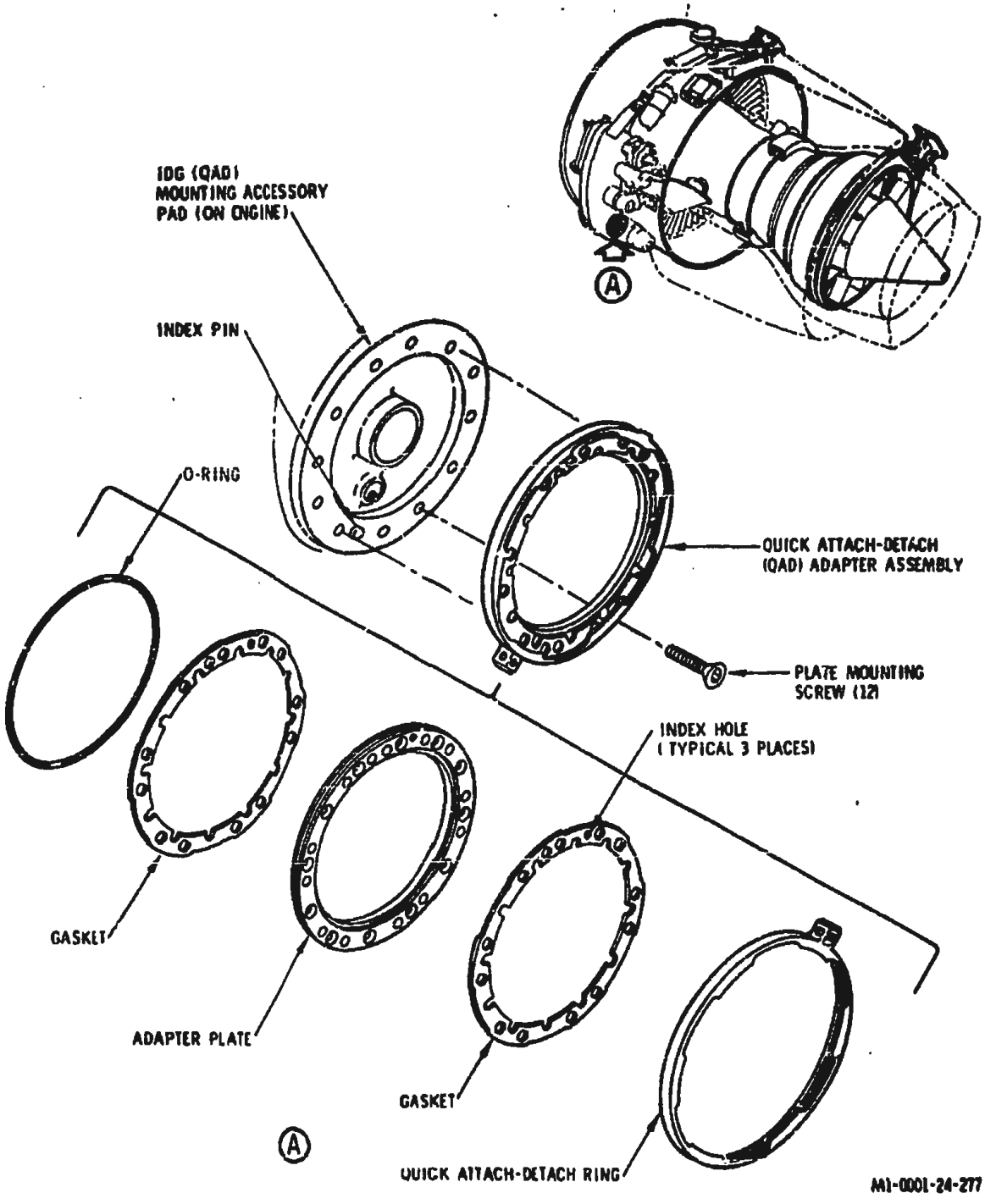
NOTE: When properly installed, the O-ring forms the primary oil seal between adapter plate flange and accessory pad.

CAUTION: TORQUE SCREWS EVENLY TO PREVENT WARPING ADAPTER PLATE.

(4) Position QAD adapter on accessory pad with alignment hole at 5:30-o'clock position. Dip mounting screws in oil, install and torque 23 to 25 lb ft. Verify that all screw heads are below surface of adapter plate. Remove any burrs if screws are staked.

NOTE: Staking of adapter mounting screws is optional.

(5) Install second gasket in preparation for installing IDG.



R IDG Transmission Quick Attach-Detach Adapter
R Removal and Installation
R Figure 401

R

THERMAL SWITCH - REMOVAL AND INSTALLATION

R 1. General

R The thermal switch is located on the integrated drive generator
R (IDG) transmission below the pressure fill port.

R 2. Equipment and Materials

R Switch, thermal PN 57975 (Ref. Fig. 401)

R O-Ring, PN M83248-1-908

R Boot, heat shrink, PN 58056-1

R Sleeving, fiberglass, PN 55134-1

R Sleeving, electrical, heat shrink, PN M23053-13-504C

R Nut, self-locking, PN NAS1291X04

R Screw, machine, pan head, PN NAS5900-3

R Heat gun, Raychem, PN CV-5700

R 3. Referenced Procedures

R	12-12-21	Integrated Drive Generator (IDG) - Oil Replenishing
R	20-03-05	Heating Tools - Maintenance Practices
R	24-11-01	IDG Assembly - Servicing
R	24-11-01	IDG Assembly - Adjustment and Test
R	24-11-01	IDG Assembly - Inspection and Check
R	24-11-01	IDG Oil Low-pressure Light - Fault Isolation, Figure 102
R	71-00-00	Powerplant - Maintenance Practices
R	71-11-00	Cowling Engines No. 1 and No. 3 - General Servicing
R	71-12-00	Engine No. 2 Cowling - General Servicing

R 4. Removal/Installation

R A. Removal

R (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker IDG OIL LOW PRESS (AA17).

R (2) Open cowl panels 413A and 414A for engine No. 1 (Ref. 71-11-00), 443AL and 434AR for engine No. 2 (Ref. 71-12-00), 423A and 424A for engine No. 3 (Ref. 71-11-00).

R (3) Drain oil from IDG (Ref. 24-11-01).

R (4) Remove identification sleeve, heat shrink electrical sleeving and fiberglass sleeving from electrical harness (Ref. Fig. 401).

R (5) Remove two (2) self-locking nuts and two (2) screws from electrical harness.

R (6) Slide boot off thermal switch.

R (7) Unscrew thermal switch and O-ring from IDG assembly.

R B. Installation

R (1) Verify circuit breaker opened in Step 4A(1) is opened and tagged.

R (2) Install O-ring on thermal switch and screw thermal switch on IDG assembly.

R (3) Install boot over thermal switch leads and heat shrink boot onto thermal switch (Ref. 20-03-05).

R (4) Slide one length (1.000 ± 0.125 inch) of fiberglass sleeving over each thermal switch lead.

R (5) Slide one length (1.000 ± 0.125 inch) electrical sleeving on electrical harness.

R (6) Slide identification sleeve on electrical harness.

R (7) Connect each thermal switch lead to electrical harness with machine screw and self-locking nut.

R (8) Slide fiberglass sleeving over terminal splice, and slide heat shrink electrical sleeving over fiberglass sleeving to ensure electrical sleeving completely covers all conductive material.

R R R R CAUTION: WHEN APPLYING HEAT TO ELECTRICAL SLEEVING TO SEAL SPLICE, ENSURE THAT HEAT DOES NOT DAMAGE WIRE AND THERMAL SWITCH LEADS OR ANY OTHER PARTS ON IDG ASSEMBLY.

R R (9) Apply heat to electrical sleeving to seal in place over terminal splice (Ref. 20-03-05).

R R (10) Slide identification sleeve over both terminal heat shrink electrical sleeves.

R (11) Fill IDG oil system (Ref. 12-12-21).

R (12) Close cowl panels opened in Step 4A(2).

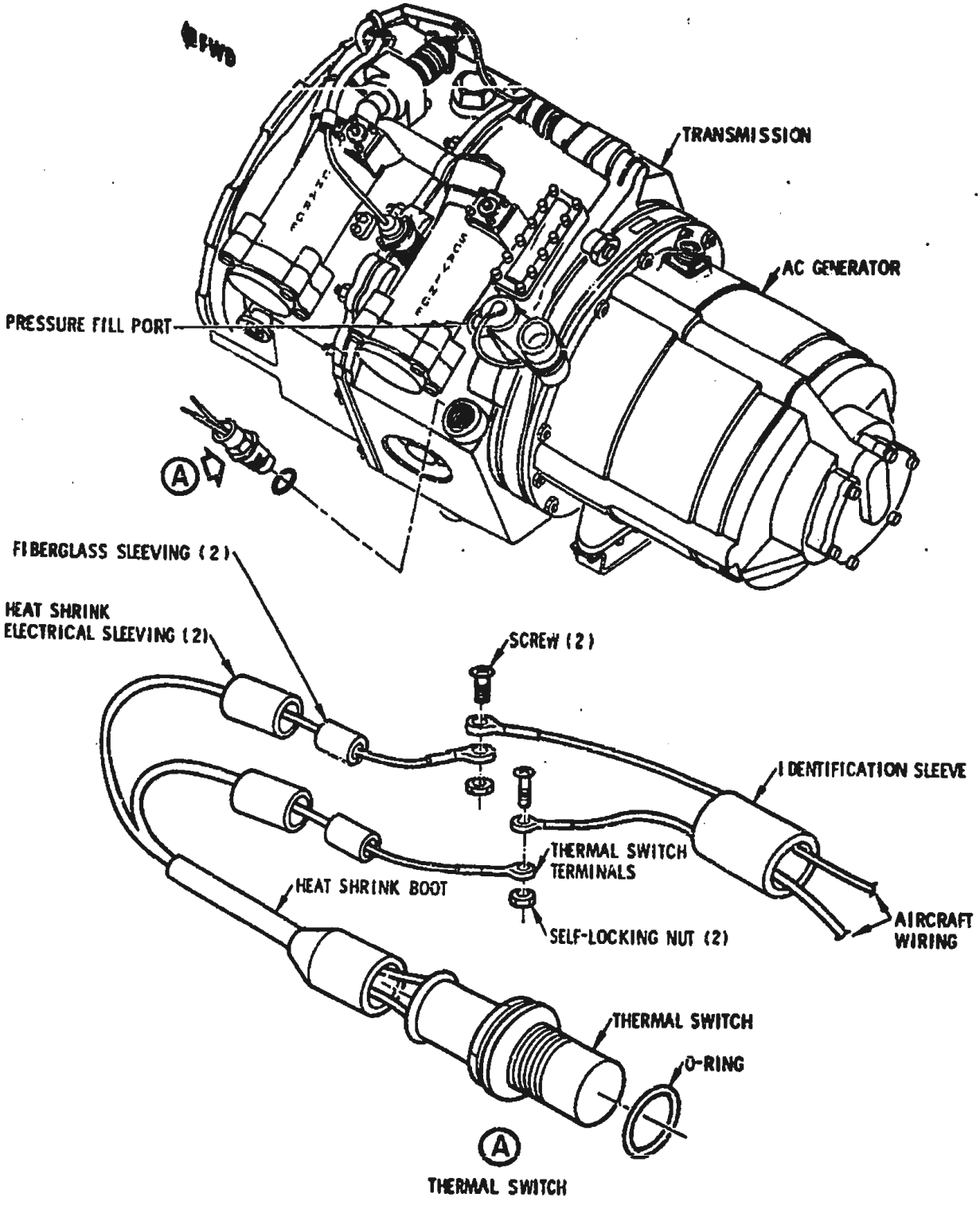
R R (13) Remove tag and close circuit breaker opened in Step 4A(1).

R (14) Start engine (Ref. 71-00-00).

R (15) Verify proper IDG oil pressure.

R (16) Shut off engine (Ref. 71-00-00).

R (17) Visually inspect IDG for oil leaks.



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R Thermal Switch - Removal and Installation
R Figure 401

R EFFECTIVITY: 001-031 WITH SUNDSTRAND SB24-1436
R AND 032-999
001B

R INTEGRATED DRIVE GENERATOR (I.D.G.) CABLES
R REMOVAL/INSTALLATION

R 1. Referenced Procedures

R 71-11-00 Cowlings, Engines No. 1 or No. 3 - Servicing.

R 71-12-01 Cowlings, Engine No. 2 - Servicing.

R 2. Removal

R A. Open right-hand hinged cowl 414A or 424A for engine No. 1 or
R No. 3 (Ref. 71-11-00) or 434AR for engine No. 2 (Ref.
R 71-12-01).

R CAUTION: ENSURE ELECTRICAL CONNECTORS ARE FREE FROM LIQUID
R AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

R B. Refer to Fig. 401, disconnect electrical connectors.

R C. Measure and record length of each cable between connector
R end and top surface of uppermost clamp (2).

R D. Refer to detail A and B, RB211-524B-02 engines without
R RR-S.B.24-5301, remove screws and washers (1).
R RB211-524B-02 engines with RR-S.B.24-5301, RB211-524B3 and
R RB211-524B4 engines remove bolts and washers (1). Leave
R bracket (4) attached to H.P. air control valve harness and
R remove clamps (2).

R E. Refer to detail C; remove bolts and washers (3) and clamps
R (2).

R F. Engines without A.I.D.S. refer to Fig. 402 (Sheet 1), remove
R bolts and washers (1) and clamps (2), bolt and washer (3)
R and bolt, washer and nut (4). Remove clips from I.D.G.
R control cable.

R G. Engines with A.I.D.S. refer to Fig. 402 (Sheet 2), remove
R bolts and washers (1), clamps (2) and bolt and washer (3).
R Remove clips from I.D.G. control cable.

R H. On RB.211-22B engine

R (1) Refer to Fig. 403 (Sheet 2), remove screw, washer and
R nut (1) and clips (2).

R H. On RB.211-524B engine

R (1) Engines without RR-S.B.24-4367 refer to Fig. 403 (Sheet 1), remove screws washers and nuts (1), screw and washer (2) and clamp (3).

R (2) Remove bolts (4) and safety plate.

R (3) Remove nuts, spring washers and washers (5). Remove I.D.G. cables from terminal posts and L.P. compressor case.

R (4) Engines with RR-S.B.24-4367 refer to Fig. 403 (Sheet 2), remove screw, washer and nut (1) and clips (2).

R I. Remove screws, washers and nuts (3), screw and washer (4), clamp (5) and spacer (6).

R J. Remove bolts and safety plate.

R K. Remove nuts, spring washers and washers (7). Remove I.D.G. cables from terminal posts and L.P. compressor case.

R 3. Installation

R A. Refer to Fig. 401, position I.D.G. cables on L.P. compressor case, fit clamps (2) align bracket (4) then loosely fit screws and washers (1) (engines without RR-S.B.24-5301) or bolts and washers (1) (engines with RR-S.B.24-5301, RB.211-524B3 and RB.211-524B4 engines).

R CAUTION: ENSURE ELECTRICAL CONNECTORS ARE FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

R B. Ensure length of each cable between connector end and top surface of uppermost clamp (2) is same as dimensions recorded in Para. 2.C. then connect electrical connectors.

R C. Engines without RR-S.B.24-5301, torque tighten screws (1) to 15 lbs-ins. (1.7Nm.). Engines with RR-S.B.24-5301, torque tighten bolts (1) to 30 lbs-ins. (3.4Nm.)

R D. Fit bolts and washers (3) and torque tighten to 30 lbs-ins. (3.4Nm.).

R E. Engines without A.I.D.S. refer to Fig. 402 (Sheet 1), fit clips to I.D.G. control cables, clamps (2), bolt and washer (3) and bolt, washer and nut (4). Fit bolts and washers (1) and torque tighten to 30 lbs-ins. (3.4Nm.)

R F. Engines with A.I.D.S. refer to Fig. 402 (Sheet 2), fit clips to I.D.G. control cables, clamps (2) and bolt and washer

R (3). Fit bolts and washers (1) and torque tighten to 30
R lbs-ins. (3.4Nm.).

R G. On RB.211-22B engine

R (1) Engines without RR-S.B.24-4367 refer to Fig. 403 (Sheet
R 1), position I.D.G. cables over terminal posts then fit
R and secure nuts, spring washers and washers (5).

R (2) Position safety plate over nuts (5) then fit and secure
R bolts (4).

R (3) Fit clamp (3) then secure with screws, washers and nuts
R (1) and screw and washer (2).

R H. Engines with RR-S.B.24-4367 refer to Fig. 403 (Sheet 2),
R position I.D.G. cables over terminal posts and loosely
R secure with nuts, spring washers and washers (7).

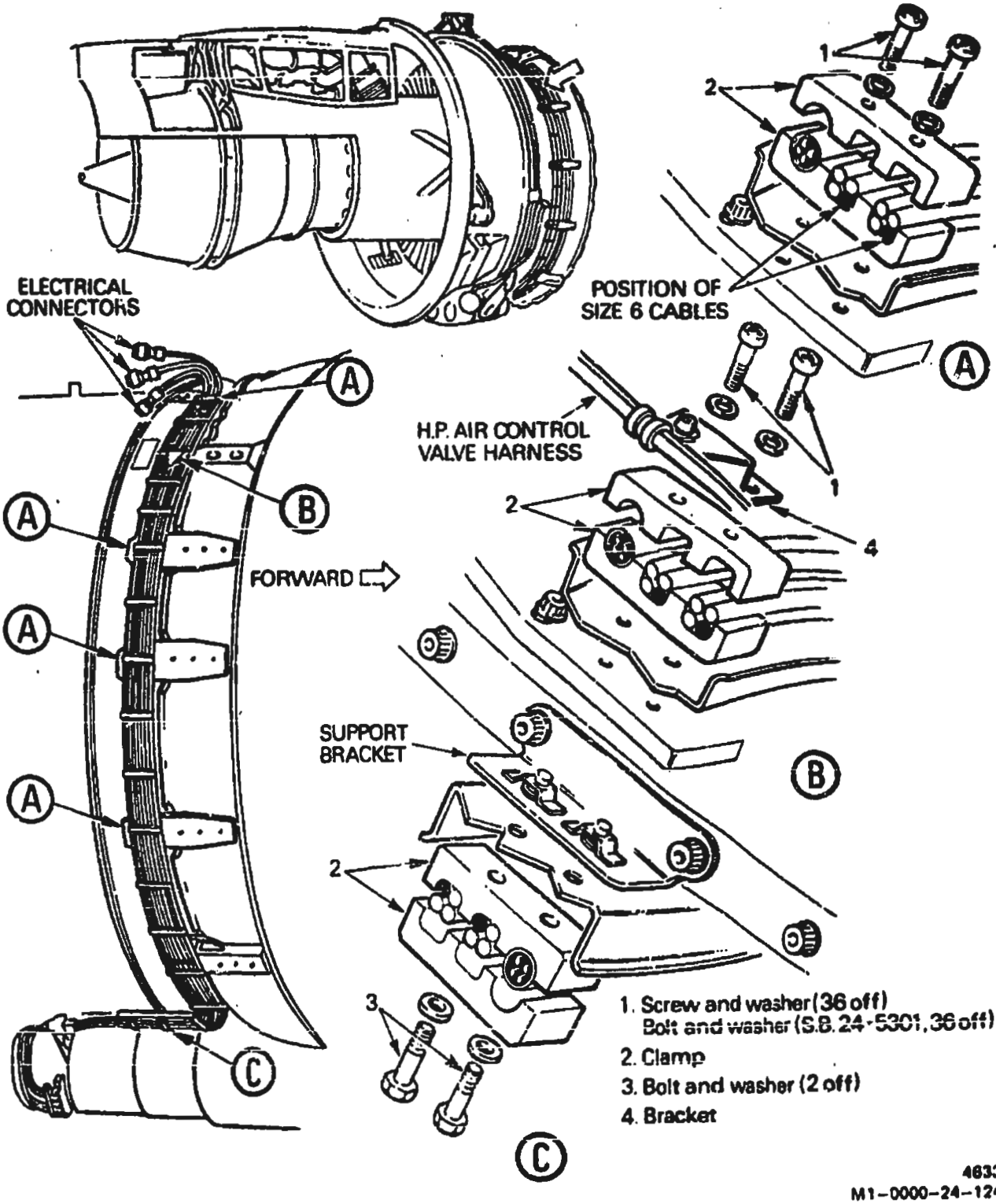
R I. Insert spacer (6) between I.D.G. cables then fit clamp (5)
R with spacer (6) interposed and loosely secure with screw and
R washer (4) and screws, washers and nuts (3).

R J. Ensure clamp (5) and spacer (6) are correctly positioned
R (see dimension on Fig. 403 (Sheet 2) then secure nuts,
R spring washers, and washers (7), screw and washer (4) and
R screws, washers and nuts (3).

R K. Position clips (2) see dimension on Fig. 403 (Sheet 2) then
R fit and secure screw, washer and nut (1).

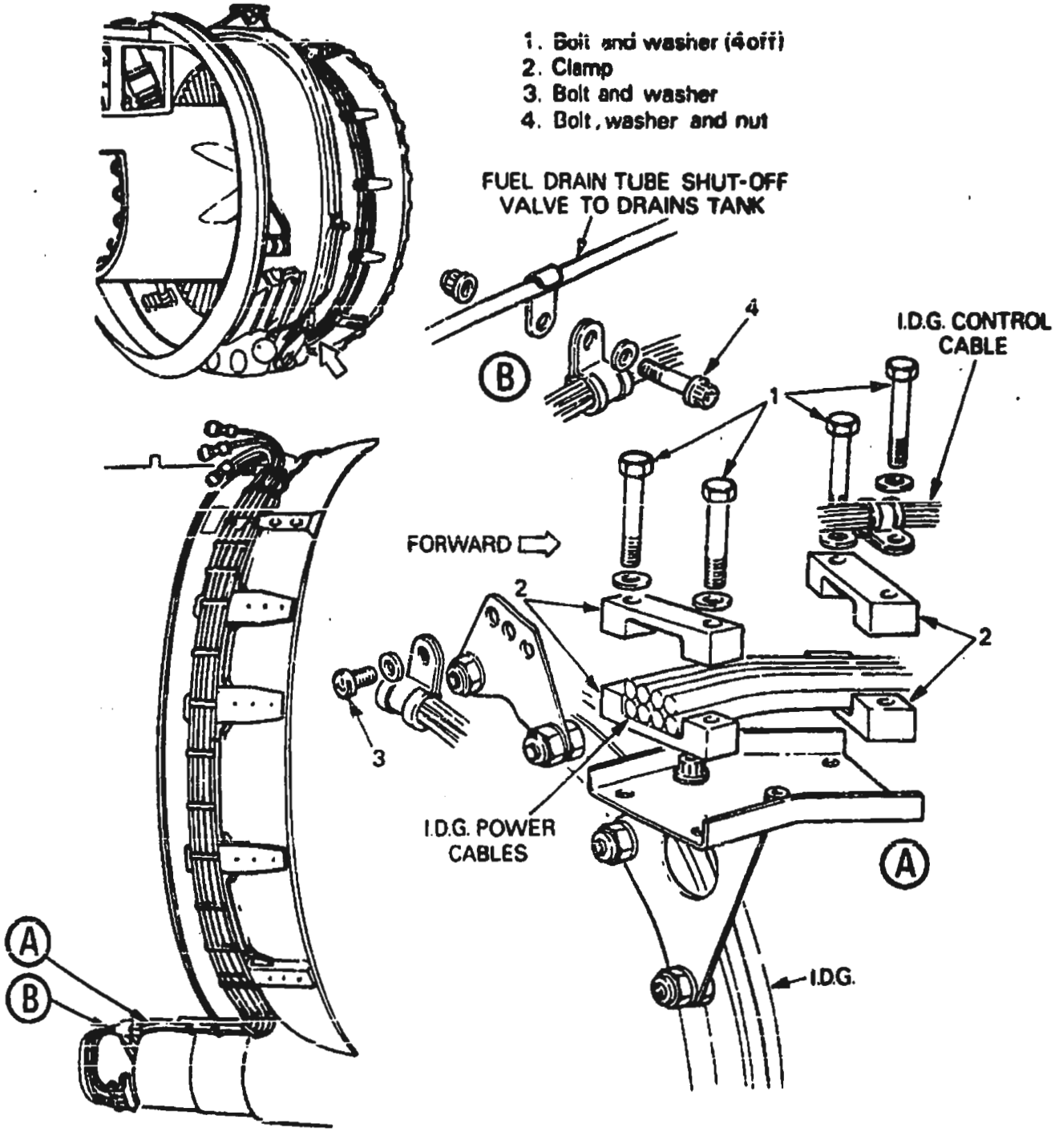
R L. Position safety plate over nuts (7) then fit and secure
R bolts.

R M. Close right-hand hinged cowl 414A or 424A for engine No. 1
R or No. 3 (Ref. 71-11-00) or 434AR for engine No. 2 (Ref.
R 71-12-01)



R I.D.G. Cables - Removal and Installation
R Figure 401

R EFFECTIVITY: ALL
R
001B



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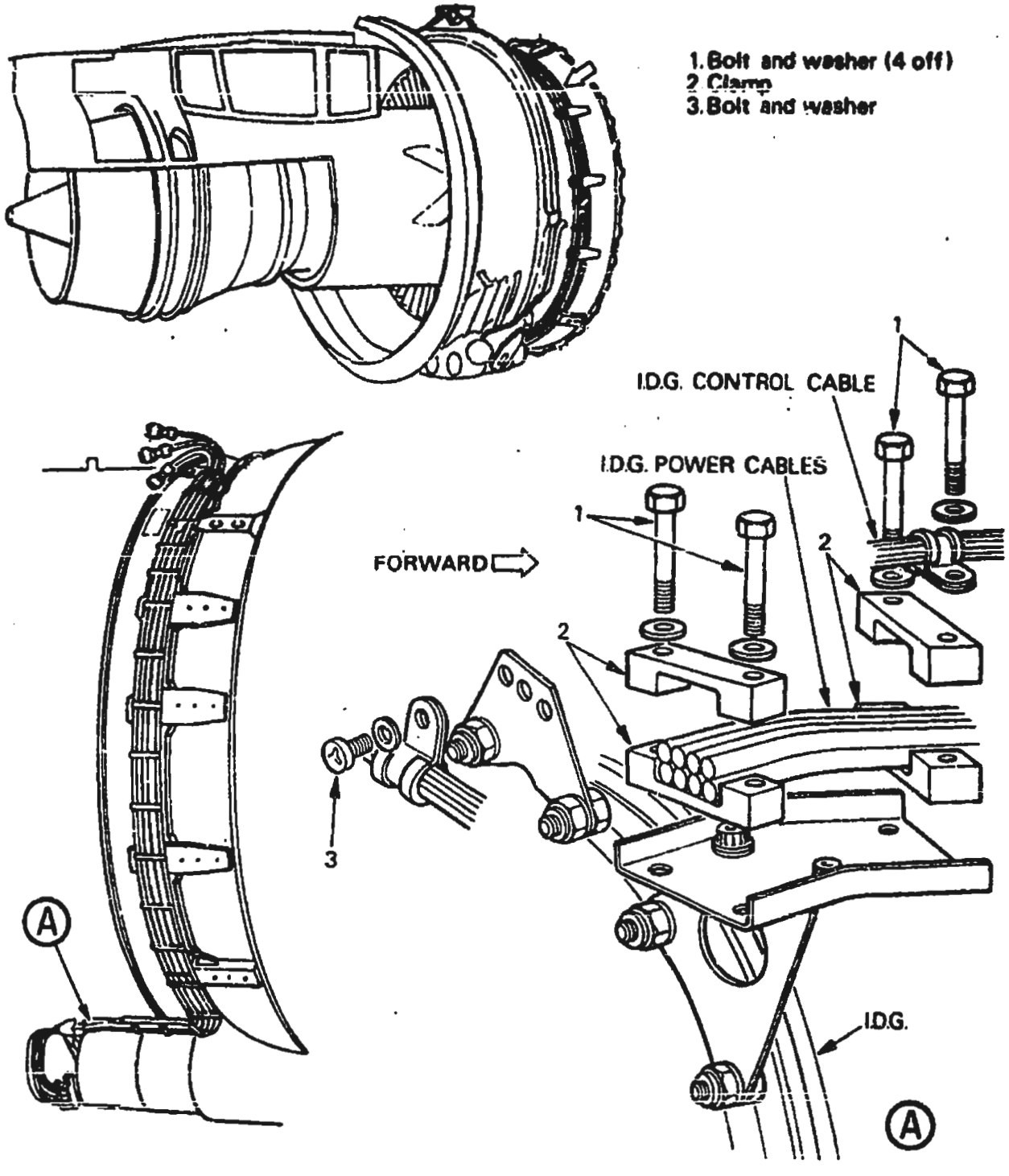
R I.D.G. Cables - Removal and Installation
R Figure 402 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



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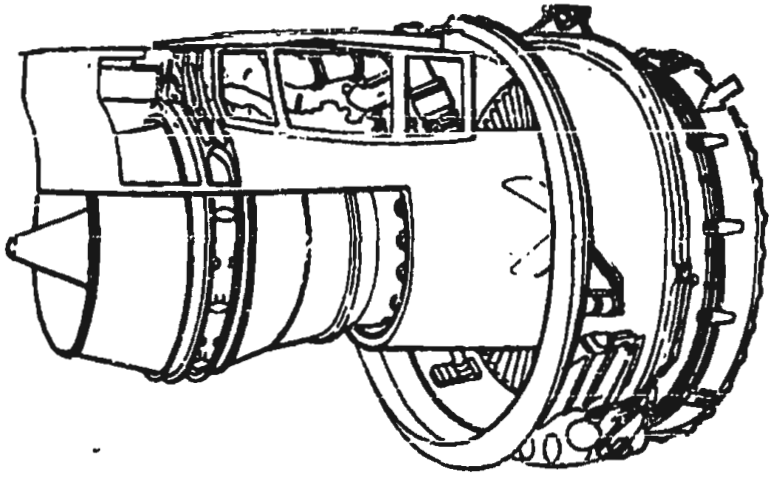
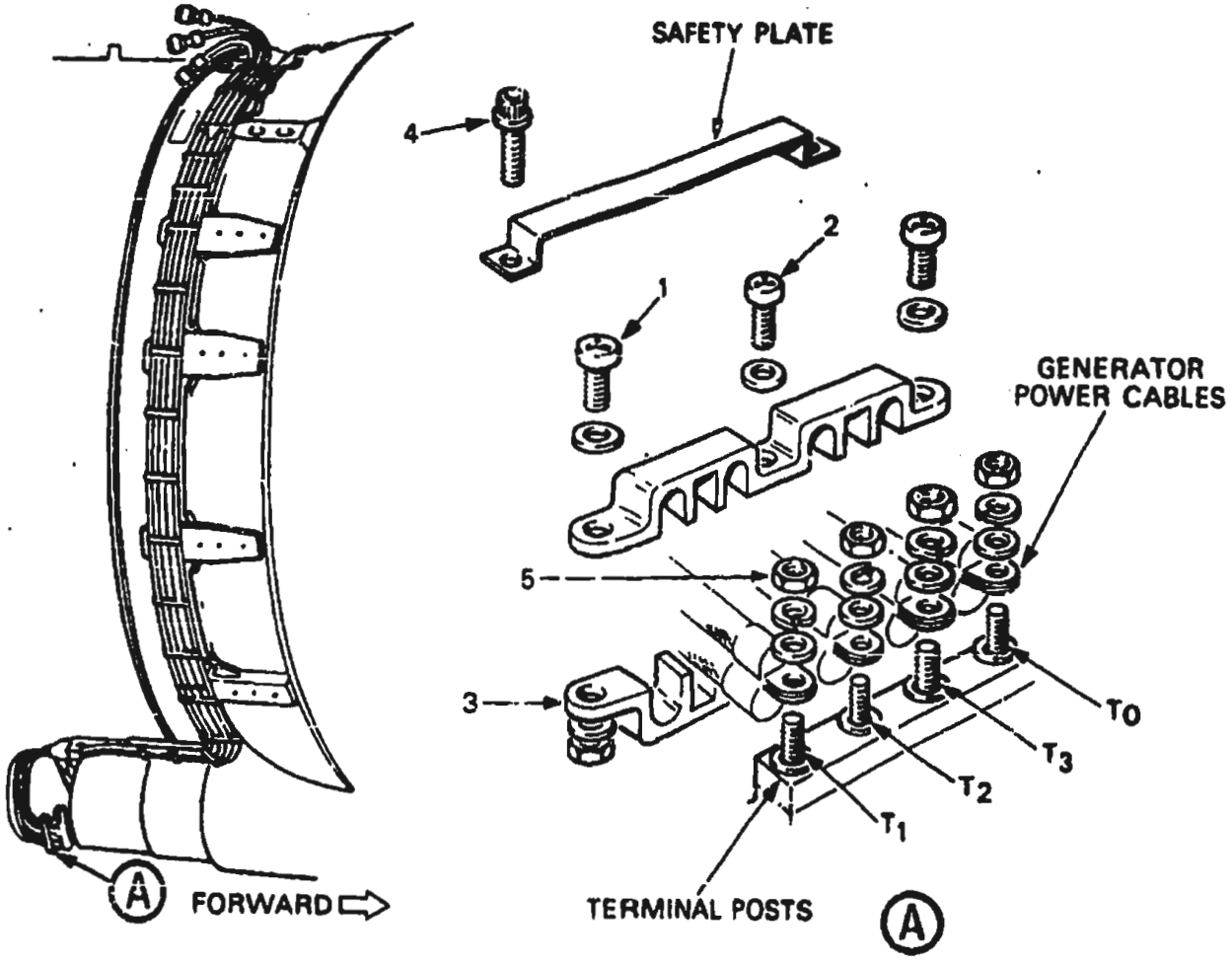
R I.D.G. Cables - Removal and Installation
R Figure 402 (Sheet 2)



1. Screw, washers and nut (2off)
2. Screw and washer
3. Clamp
4. Bolt (2off)
5. Nut, spring washer and washer (4off)



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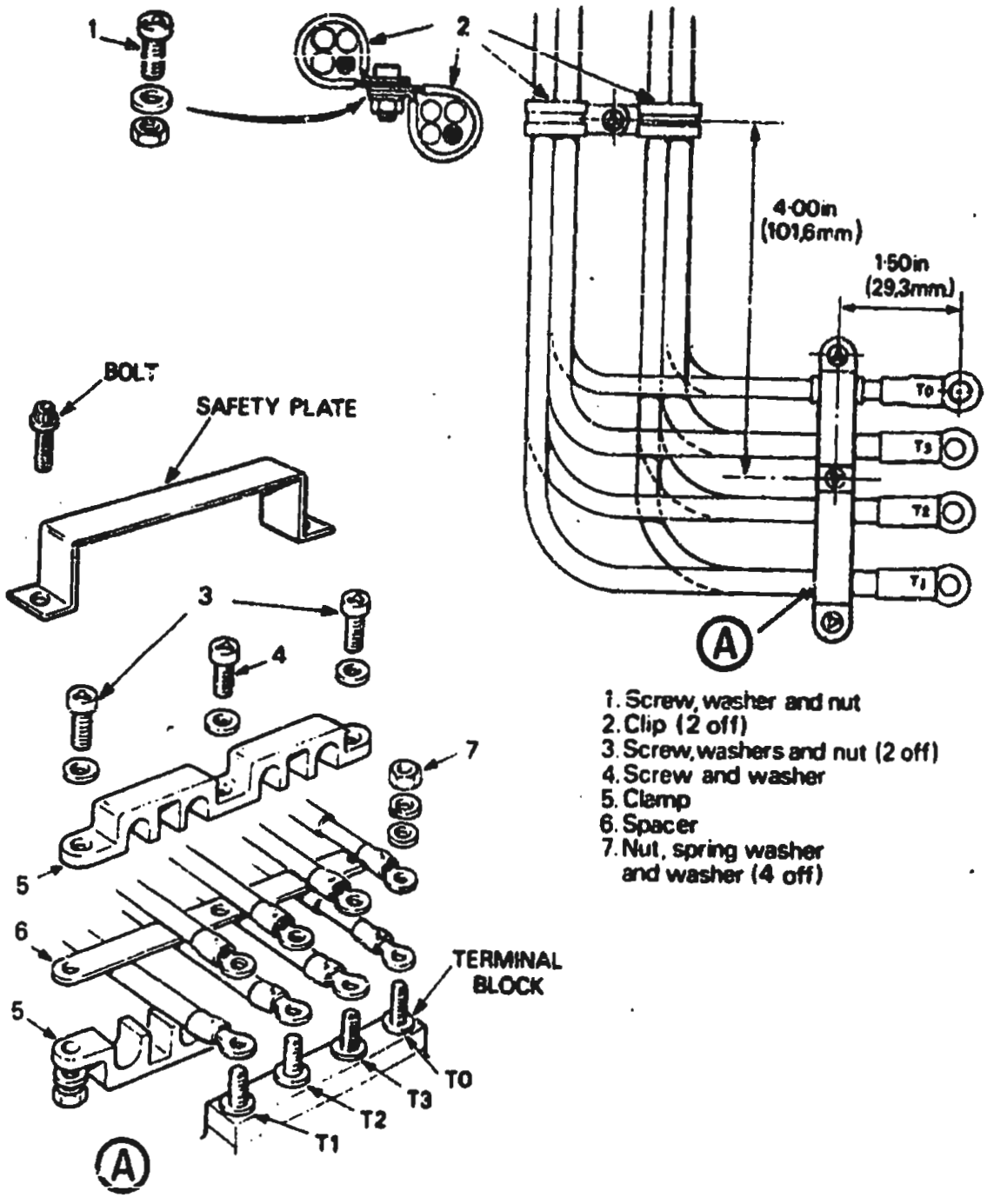
R I.D.G. Cables - Removal and Installation
R Figure 403 (Sheet 1)

R EFFECTIVITY: ALL
R
001B



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R I.D.G. Cables - Removal and Installation
R Figure 403 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

APU GENERATOR ADAPTER - DESCRIPTION AND OPERATION

1. General

The APU generator adapter serves as a direct-drive mounting pad for installing the generator on the APU. The generator (Ref. 24-24-00) is shop-mated to the adapter to form an assembly which is removed and installed as a single unit. The adapter contains an oil pump system which provides lubricating and cooling oil for the generator. Pressure and temperature sensing switches located within the adapter case provide signals to light indicators in the flight station whenever an abnormal adapter condition exists.

2. Adapter

A. Description

The APU generator adapter, which provides the means of mounting the generator on the APU, is the source of the generator lubrication and cooling oil. Table 1 lists adapter characteristics.

Characteristics of the APU Generator Adapter
Table 1

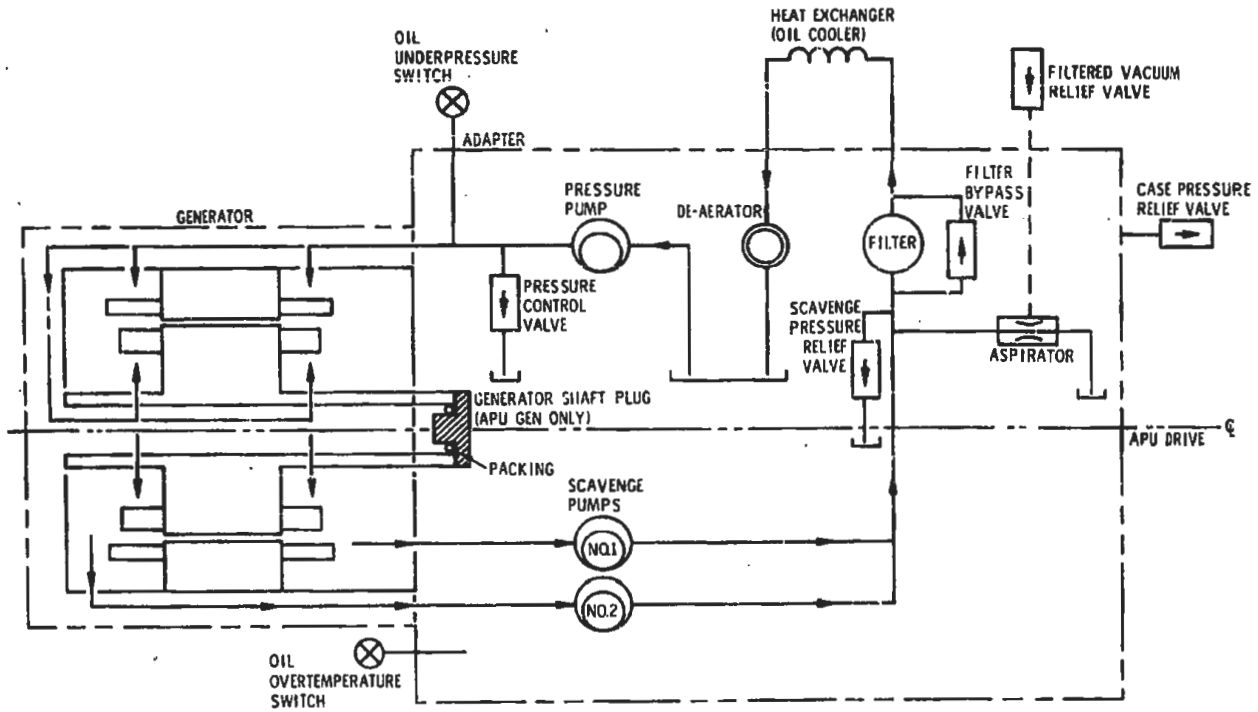
ITEM	CHARACTERISTIC
SHAFT SPEED AND DIRECTION OF ROTATION	
Input speed	12,000 rated rpm 14,400 maximum rpm
Input rotation (looking into input)	Clockwise
Output speed	Same as input speed
Output rating	144 hp
Overload capacity	200 percent
ENVIRONMENTAL CONDITIONS	
Maximum operational altitude	30,000 feet
Oil temperature operating range	25 to 225°F
WEIGHTS, PRESSURES, AND CAPACITIES	

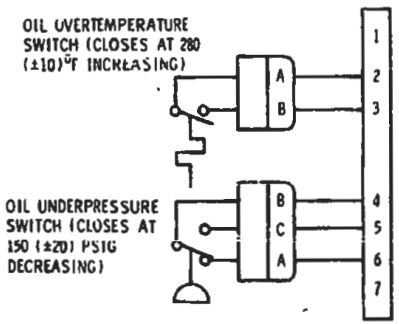
Characteristics of the APU Generator Adapter (Cont)
Table 1

ITEM	CHARACTERISTIC
Dry weight of adapter	20.1 pounds
Cooling oil flow (at rated speed)	5.6 gal/min
Scavenge pump rating (each)	4.0 gal/min (minimum) at 100 psi
Oil capacity (with generator)	4.5 US quarts (Esso or Enco Turbo Oil 2380) or equivalent
FILTER	
Disposable filter element	40 microns nominal, 70 microns absolute
Clogged filter indicator	Activates at 70 psi differential
Filter bypass valve	Opens at 100 psi differential
PROTECTIVE DEVICES	
Overtemperature switch (oil)	Closes at 280°F (approx)
Underpressure switch (oil)	Closes at 150 psig (decr)
Magnetic drain plug	

The adapter (Ref. Fig. 1) uses a split drive shaft assembly having an integral male spline on the drive end which mates with the female spline on the engine accessory mounting pad. Two bearings support the drive shaft and serve as the drive end bearings for the generator. The output end of the shaft assembly has an integrally mounted gear which mates with the drive gear on the three element pump in the lubricating and cooling oil system. An integral female spline on the output end of the drive shaft assembly contains a spline insert which locks it with the input element and accepts the male spline on the generator.

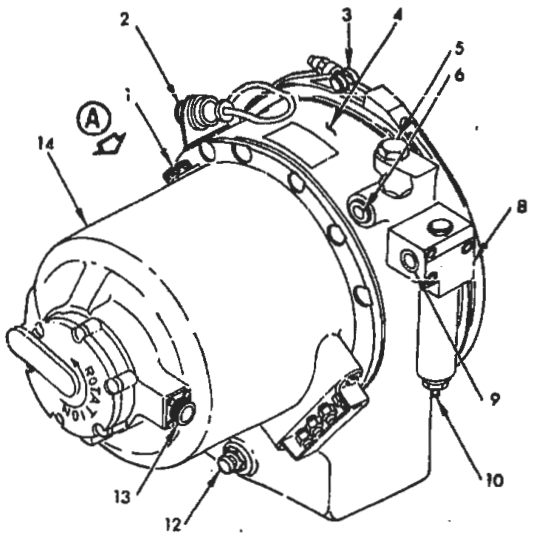
The shaft assembly has preformed seals to prevent oil leakage.

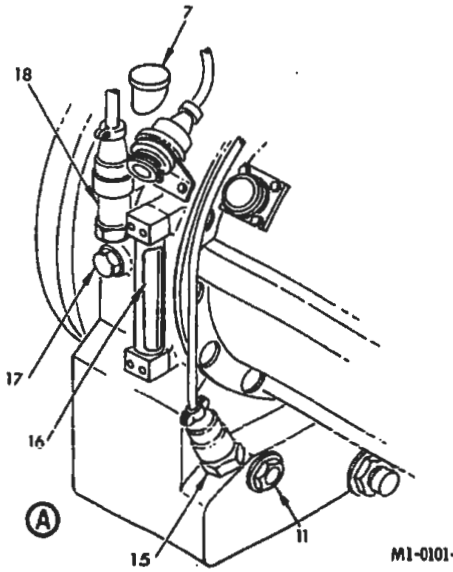




ADAPTER ELECTRICAL SCHEMATIC

1 CURRENT TRANSFORMERS AND EXCITER CONNECTORS
2 ADAPTER ELECTRICAL CONNECTOR
3 V BAND COUPLING
4 ADAPTER
5 GRAVITY FILL PORT
6 OIL IN PORT
7 CASE VACUUM RELIEF VALVE AND AIR FILTER
8 OIL FILTER AND BYPASS VALVE
9 OIL OUT PORT
10 DIFFERENTIAL PRESSURE INDICATOR BUTTON
11 PRESSURE FILL PORT
12 MAGNETIC CHIP DETECTOR AND DRAIN PORT
13 PERMANENT MAGNET GENERATOR CONNECTOR
14 GENERATOR
15 OIL OVERTEMPERATURE SWITCH
16 OIL LEVEL SIGHT GLASS
17 PRESSURE CONTROL VALVE STRAINER
18 OIL UNDERPRESSUER SWITCH





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APU Generator Assembly
Figure 1

The lubrication system consists of the following components:

Three element pump (one pressure and two scavenge)

Pressure relief valve

Heat exchanger (oil cooler)

Heat exchanger bypass valve

Oil filter

Filter bypass valve

Aspirator assembly

Vacuum relief valve

De-aerator

Oil level sight glass

Oil reservoir (bottom portion of adapter housing)

Magnetic chip detector

Under-pressure switch

Over-temperature switch

B. Operation

R The pressure section of the three element pump draws oil from the reservoir. When the input shaft is driven at its normal speed (12,000 rpm), the pump supplies 5.6 gallons per minute of oil to the generator for cooling and lubrication. The cooled oil returns to the reservoir through a de-aerator to prevent excessive foaming.

The two scavenge sections of the pump draw oil from the generator and force it through the filter, oil cooling heat exchanger, and de-aerator. When the oil is extremely viscous, causing a back pressure to build up at the heat exchanger, a bypass valve upstream of the filter bypasses part of the oil into the oil reservoir. The externally mounted oil filter assembly incorporates a disposable filter element which filters the oil on its way to the heat exchanger.

A pressure sensing device, located at the bottom of the filter bowl, gives a visual indication of the condition of the filter element. The indicator automatically trips, as

indicated by a red button extending downward, any time the differential pressure exceeds 70 psig. The increase in pressure is caused by restricted flow through the filter element, thus indicating the element is dirty and should be replaced.

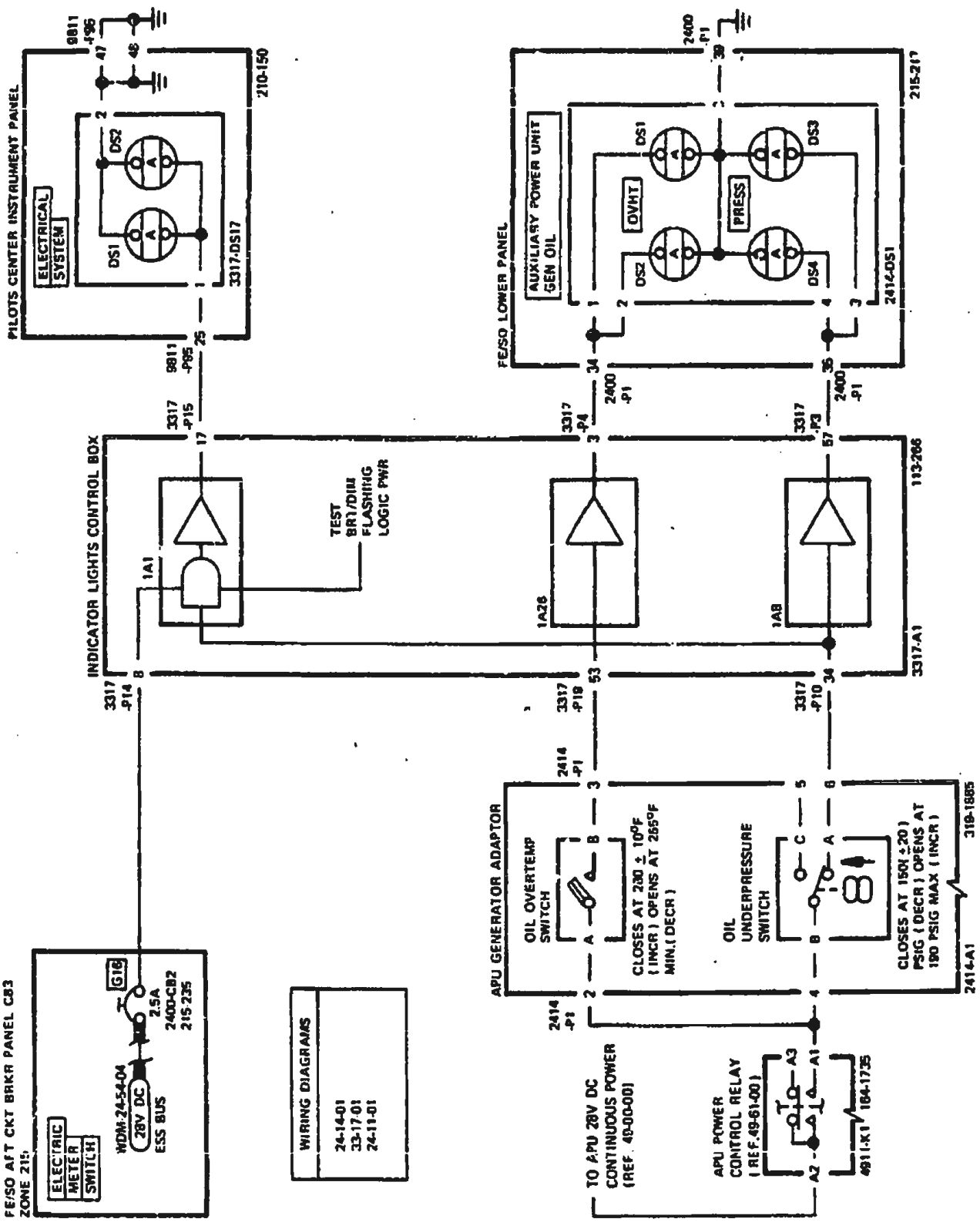
A bypass valve, located in the filter housing, opens whenever the filter becomes clogged or when the oil is extremely viscous. This assures a free flow of lubricating and cooling oil to the generator at all times. The pressure regulator valve, located in the adapter housing assembly, maintains the pressure of the supply oil at a predetermined value.

A filtered vacuum relief valve, located directly above the filter assembly, allows air to be drawn into the system. The aspirator assembly removes air from the oil thus preventing air locks.

An under-pressure sensing switch and an over-temperature sensing switch, both located in the sump, provide signals to cause GEN OIL PRESS and GEN OIL OVHT caution lights on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, to come on under certain conditions (Ref. Fig. 2). The GEN OIL PRESS light comes on whenever the oil pressure decreases to 150 (±20) psig. The GEN OIL OVHT light comes on whenever the oil temperature increases to 280 (±10) degrees F.

Whenever the GEN OIL PRESS light comes on, the ELECTRICAL SYSTEM annunciator light on the pilots center instrument panel, zone 210, begins to flash. Refer to 33-17-00 for description and operation of the annunciator system.

The adapter case is self-pressurized. A pressure relief valve vents into the mount pad area, and a vacuum relief and inlet air filter unit is mounted on the top right side of the case.



R APU Generator Adapter Fault Indication Functional Diagram
R Figure 2

APU GENERATOR SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 24 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

TABLE 101

	FIGURE	TITLE
	101	Component Location Index
	102	Component Locator Diagram
	103	APU Generator Oil Pressure Fault Isolation
R	104	APU Generator Oil Overheat Fault Isolation
	SCHEM 1	APU Generator Oil Underpressure and Overheat Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
APU	1	APU ACCESS 319AL/319CL	49-00-01
CONTROL BOX – INDICATOR LIGHTS	1	FESC; 112AB	33-17-04
GENERATOR CONTROL UNIT	1	MESC; 192K/197AZ	24-31-00
GENERATOR – APU	1	319AL/319CL	24-20-01
OIL COOLER	1	319AL/319CL	49-01-01
SWITCH – APU ADAPTOR OIL OVERTEMPERATURE	1	319AL/319CL	24-14-03
SWITCH – APU ADAPTOR OIL UNDERPRESSURE	1	319AL/319CL	24-14-04

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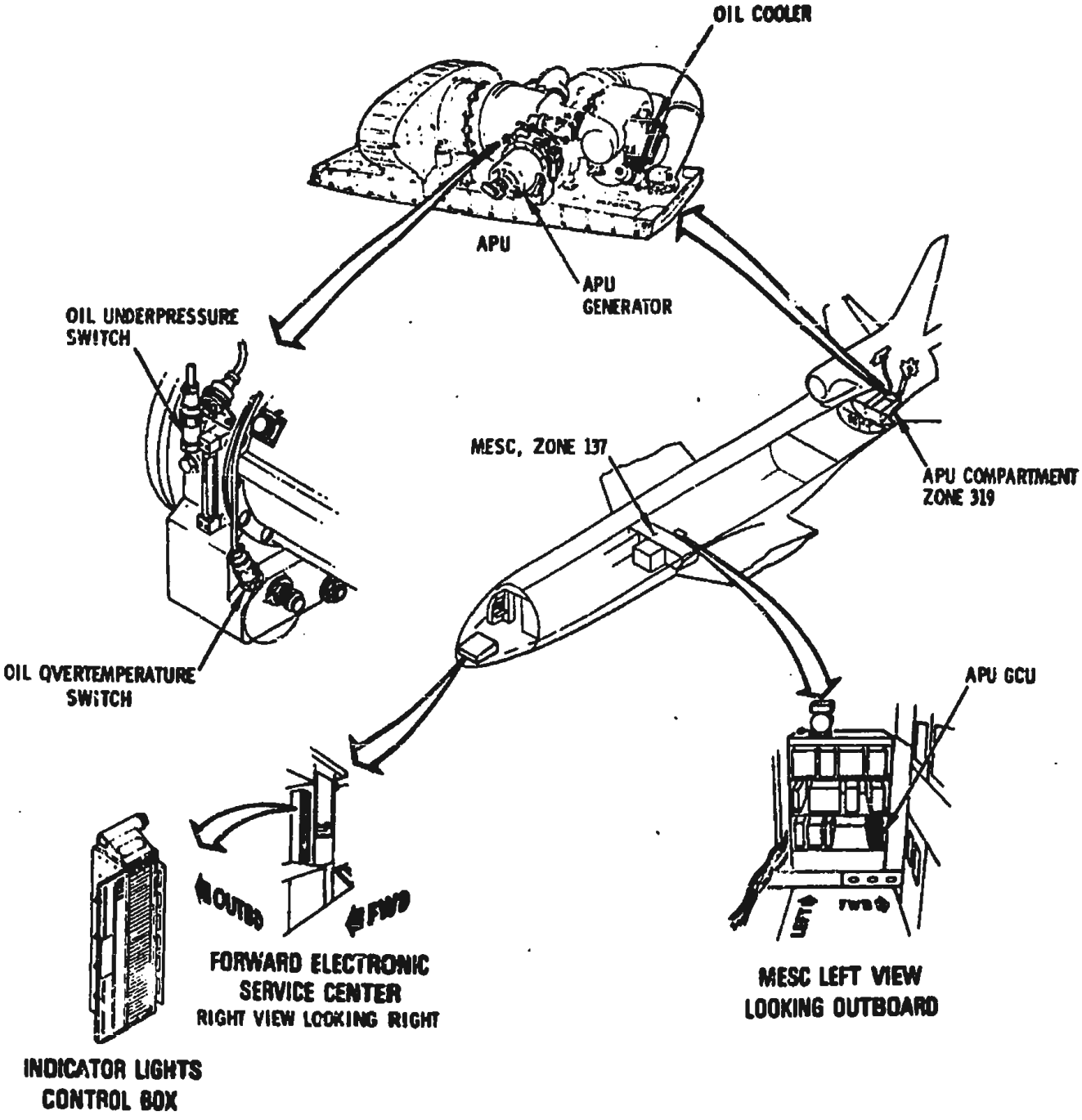
R Component Location Index
R Figure 101



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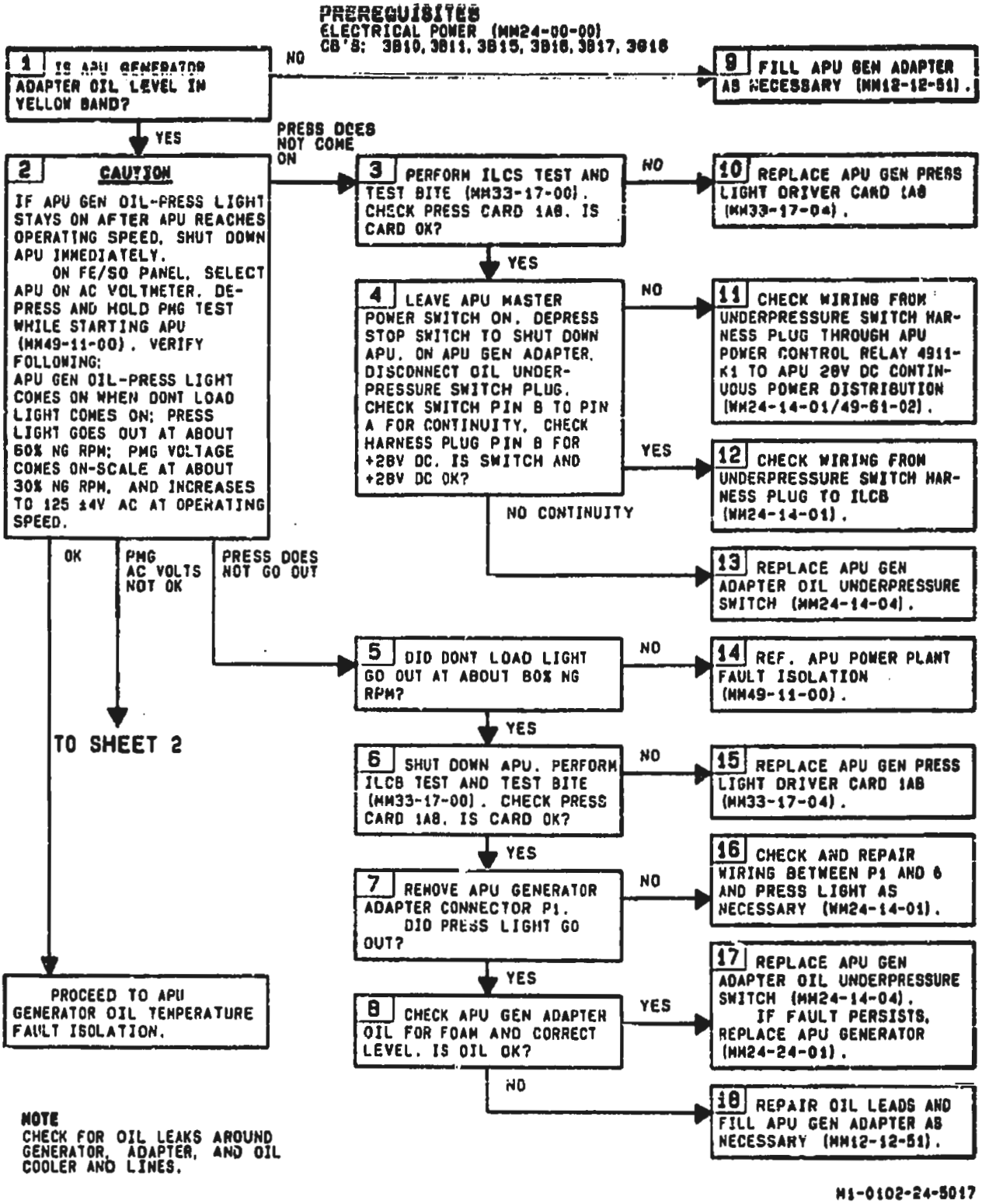
R
R

Component Locator Diagram
Figure 102

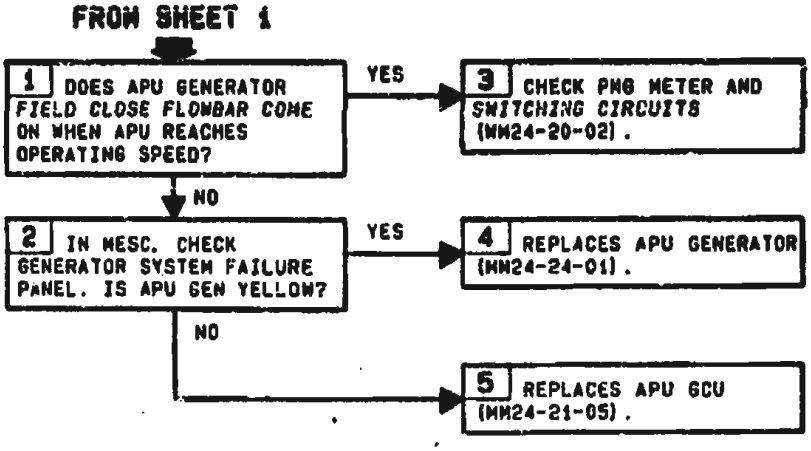
EFFECTIVITY: ALL

0018


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 3B10, 3B11, 3B15, 3B16, 3B17, 3B18
1 IS APU GENERATOR ADAPTER OIL LEVEL IN YELLOW BAND?
NO
9 FILL APU GEN ADAPTER AS NECESSARY (MM12-12-51).
YES
PRESS DOES NOT COME ON
2 CAUTION
IF APU GEN OIL-PRESS LIGHT STAYS ON AFTER APU REACHES OPERATING SPEED, SHUT DOWN APU IMMEDIATELY.
ON FE/SO PANEL, SELECT APU ON AC VOLTMETER. DEPRESS AND HOLD PMG TEST WHILE STARTING APU (MM49-11-00). VERIFY FOLLOWING:
APU GEN OIL-PRESS LIGHT COMES ON WHEN DONT LOAD LIGHT COMES ON; PRESS LIGHT GOES OUT AT ABOUT 60% NG RPM; PMG VOLTAGE COMES ON-SCALE AT ABOUT 30% NG RPM, AND INCREASES TO 125 ±4V AC AT OPERATING SPEED.
3 PERFORM ILCS TEST AND TEST BITE (MM33-17-00). CHECK PRESS CARD 1A8. IS CARD OK?
NO
10 REPLACE APU GEN PRESS LIGHT DRIVER CARD 1A8 (MM33-17-04).
YES
4 LEAVE APU MASTER POWER SWITCH ON. DEPRESS STOP SWITCH TO SHUT DOWN APU. ON APU GEN ADAPTER, DISCONNECT OIL UNDERPRESSURE SWITCH PLUG. CHECK SWITCH PIN B TO PIN A FOR CONTINUITY. CHECK HARNESS PLUG PIN B FOR +28V DC. IS SWITCH AND +28V DC OK?
NO
11 CHECK WIRING FROM UNDERPRESSURE SWITCH HARNESS PLUG THROUGH APU POWER CONTROL RELAY 4911-K1 TO APU 28V DC CONTINUOUS POWER DISTRIBUTION (MM24-14-01/49-61-02).
YES
12 CHECK WIRING FROM UNDERPRESSURE SWITCH HARNESS PLUG TO ILCB (MM24-14-01).
NO CONTINUITY
13 REPLACE APU GEN ADAPTER OIL UNDERPRESSURE SWITCH (MM24-14-04).
OK
PMG AC VOLTS NOT OK
PRESS DOES NOT GO OUT
TO SHEET 2
5 DID DONT LOAD LIGHT GO OUT AT ABOUT 80% NG RPM?
NO
14 REF. APU POWER PLANT FAULT ISOLATION (MM49-11-00).
YES
6 SHUT DOWN APU. PERFORM ILCB TEST AND TEST BITE (MM33-17-00). CHECK PRESS CARD 1A8. IS CARD OK?
NO
15 REPLACE APU GEN PRESS LIGHT DRIVER CARD 1A8 (MM33-17-04).
YES
7 REMOVE APU GENERATOR ADAPTER CONNECTOR P1. DID PRESS LIGHT GO OUT?
NO
16 CHECK AND REPAIR WIRING BETWEEN P1 AND 6 AND PRESS LIGHT AS NECESSARY (MM24-14-01).
YES
8 CHECK APU GEN ADAPTER OIL FOR FOAM AND CORRECT LEVEL. IS OIL OK?
YES
17 REPLACE APU GEN ADAPTER OIL UNDERPRESSURE SWITCH (MM24-14-04). IF FAULT PERSISTS, REPLACE APU GENERATOR (MM24-24-01).
NO
18 REPAIR OIL LEADS AND FILL APU GEN ADAPTER AS NECESSARY (MM12-12-51).
PROCEED TO APU GENERATOR OIL TEMPERATURE FAULT ISOLATION.
NOTE
CHECK FOR OIL LEAKS AROUND GENERATOR, ADAPTER, AND OIL COOLER AND LINES.
M1-0102-24-5017

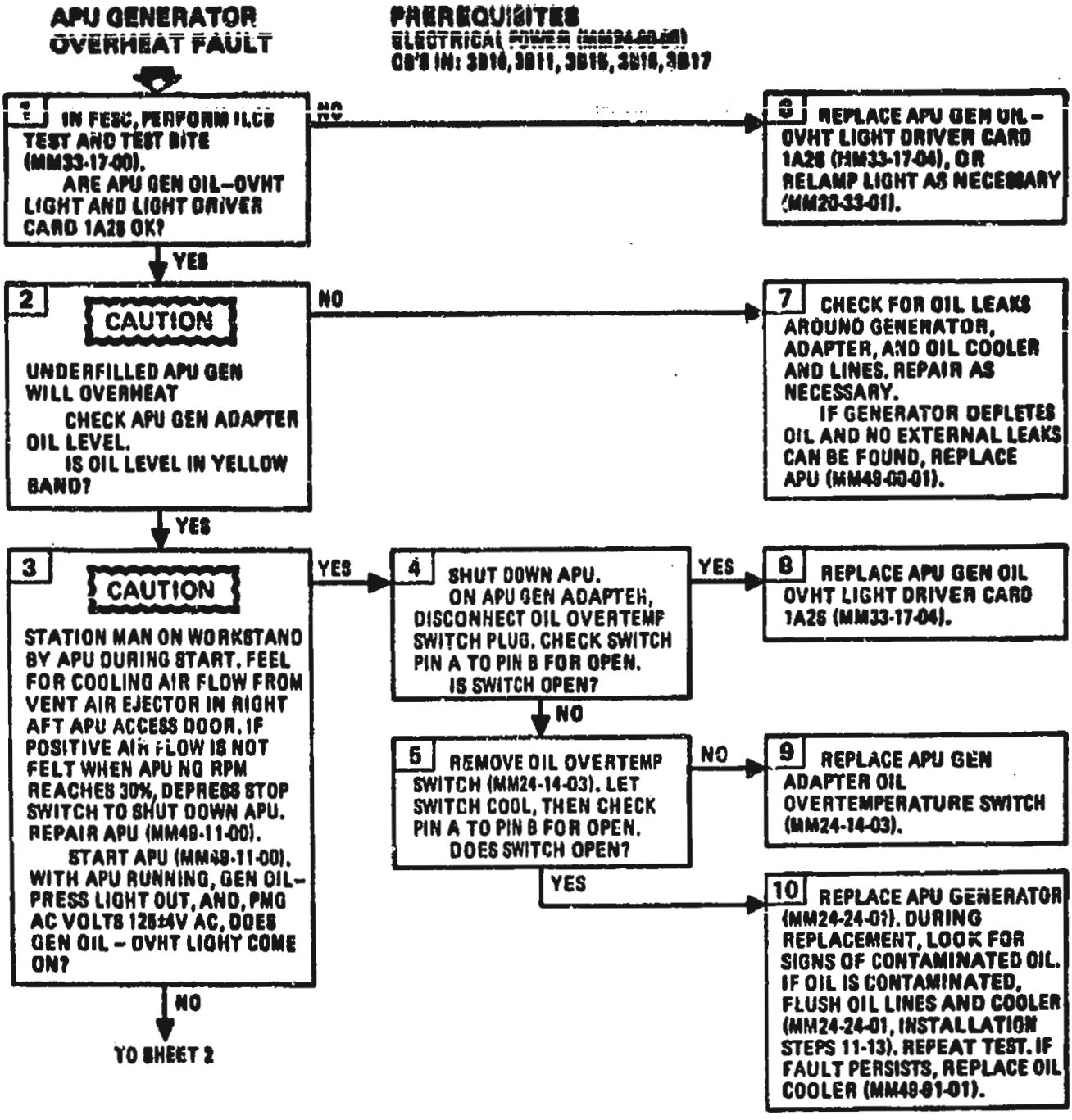
R APU Generator Oil PRESS (Underpressure) Fault Isolation
R Figure 103 (Sheet 1)

PREREQUISITES
SEE SHEET 1


FROM SHEET 1
1 DOES APU GENERATOR FIELD CLOSE FLOWBAR COME ON WHEN APU REACHES OPERATING SPEED?
YES
3 CHECK PMG METER AND SWITCHING CIRCUITS (MM24-20-02).
NO
2 IN MESC. CHECK GENERATOR SYSTEM FAILURE PANEL. IS APU GEN YELLOW?
YES
4 REPLACES APU GENERATOR (MM24-24-01).
NO
5 REPLACES APU GCU (MM24-21-05).

M1-0000-24-5061

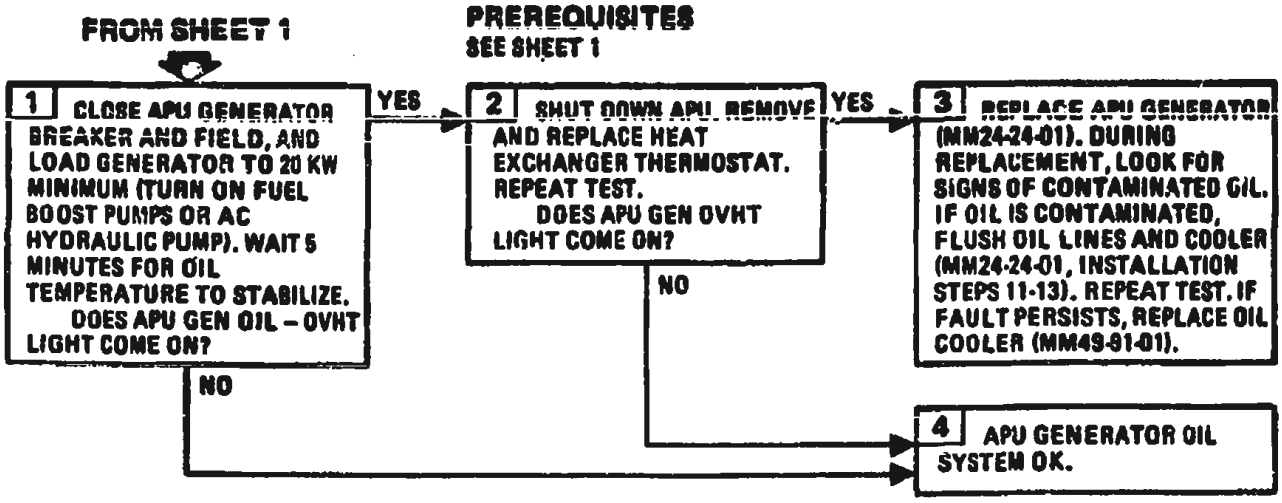
R APU Generator Oil PRESS (Underpressure) Fault Isolation
R Figure 103 (Sheet 2)


APU GENERATOR OVERHEAT FAULT
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S IN: 3B10, 3B11, 3B15, 3B16, 3B17
1 IN FESC, PERFORM ILCB TEST AND TEST BITE (MM33-17-00).
ARE APU GEN OIL–OVHT LIGHT AND LIGHT DRIVER CARD 1A26 OK?
NO
6 REPLACE APU GEN OIL – OVHT LIGHT DRIVER CARD 1A26 (MM33-17-04), OR RELAMP LIGHT AS NECESSARY (MM20-33-01).
YES
2 CAUTION
UNDERFILLED APU GEN WILL OVERHEAT
CHECK APU GEN ADAPTER OIL LEVEL.
IS OIL LEVEL IN YELLOW BAND?
NO
7 CHECK FOR OIL LEAKS AROUND GENERATOR, ADAPTER, AND OIL COOLER AND LINES. REPAIR AS NECESSARY.
IF GENERATOR DEPLETES OIL AND NO EXTERNAL LEAKS CAN BE FOUND, REPLACE APU (MM49-00-01).
YES
3 CAUTION
STATION MAN ON WORKSTAND BY APU DURING START. FEEL FOR COOLING AIR FLOW FROM VENT AIR EJECTOR IN RIGHT AFT APU ACCESS DOOR. IF POSITIVE AIR FLOW IS NOT FELT WHEN APU NG RPM REACHES 30%, DEPRESS STOP SWITCH TO SHUT DOWN APU. REPAIR APU (MM49-11-00).
START APU (MM49-11-00). WITH APU RUNNING, GEN OIL–PRESS LIGHT OUT, AND, PMG AC VOLTS 125±4V AC, DOES GEN OIL – OVHT LIGHT COME ON?
YES
4 SHUT DOWN APU.
ON APU GEN ADAPTER, DISCONNECT OIL OVERTEMP SWITCH PLUG. CHECK SWITCH PIN A TO PIN B FOR OPEN.
IS SWITCH OPEN?
YES
8 REPLACE APU GEN OIL OVHT LIGHT DRIVER CARD 1A26 (MM33-17-04).
NO
5 REMOVE OIL OVERTEMP SWITCH (MM24-14-03). LET SWITCH COOL, THEN CHECK PIN A TO PIN B FOR OPEN.
DOES SWITCH OPEN?
NO
9 REPLACE APU GEN ADAPTER OIL OVERTEMPERATURE SWITCH (MM24-14-03).
YES
10 REPLACE APU GENERATOR (MM24-24-01). DURING REPLACEMENT, LOOK FOR SIGNS OF CONTAMINATED OIL. IF OIL IS CONTAMINATED, FLUSH OIL LINES AND COOLER (MM24-24-01, INSTALLATION STEPS 11-13). REPEAT TEST. IF FAULT PERSISTS, REPLACE OIL COOLER (MM49-81-01).
TO SHEET 2

ABBREVIATIONS
FESC FORWARD ELECTRONIC SERVICE CENTER
ILCB INDICATOR LIGHTS CONTROL BOX
PMG PERMANENT MAGNET GENERATOR

M1–0002–24–5018

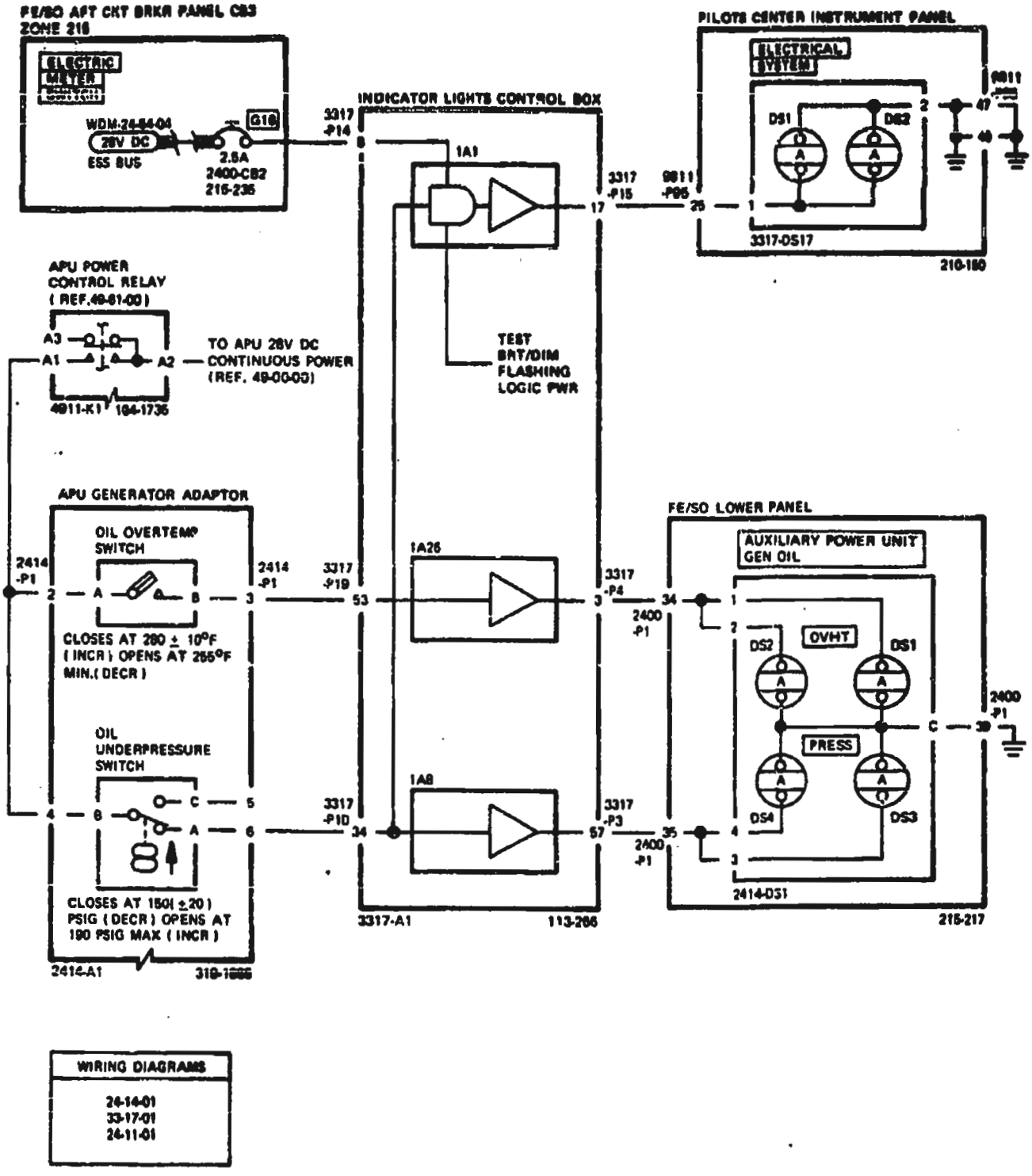
APU Generator Oil OVHT (Overheat) Fault Isolation
Figure 104 (Sheet 1)


FROM SHEET 1
PREREQUISITES
SEE SHEET 1
1 CLOSE APU GENERATOR BREAKER AND FIELD, AND LOAD GENERATOR TO 20 KW MINIMUM (TURN ON FUEL BOOST PUMPS OR AC HYDRAULIC PUMP). WAIT 5 MINUTES FOR OIL TEMPERATURE TO STABILIZE. DOES APU GEN OIL – OVHT LIGHT COME ON?
YES
2 SHUT DOWN APU. REMOVE AND REPLACE HEAT EXCHANGER THERMOSTAT. REPEAT TEST. DOES APU GEN OVHT LIGHT COME ON?
YES
3 REPLACE APU GENERATOR (MM24-24-01). DURING REPLACEMENT, LOOK FOR SIGNS OF CONTAMINATED OIL. IF OIL IS CONTAMINATED, FLUSH OIL LINES AND COOLER (MM24-24-01, INSTALLATION STEPS 11-13). REPEAT TEST. IF FAULT PERSISTS, REPLACE OIL COOLER (MM49-81-01).
NO
NO
4 APU GENERATOR OIL SYSTEM OK.

ABBREVIATIONS
FESC FORWARD ELECTRONIC SERVICE CENTER
ILCB INDICATOR LIGHTS CONTROL BOX
PMG PERMANENT MAGNET GENERATOR

M1–0000–24–5048

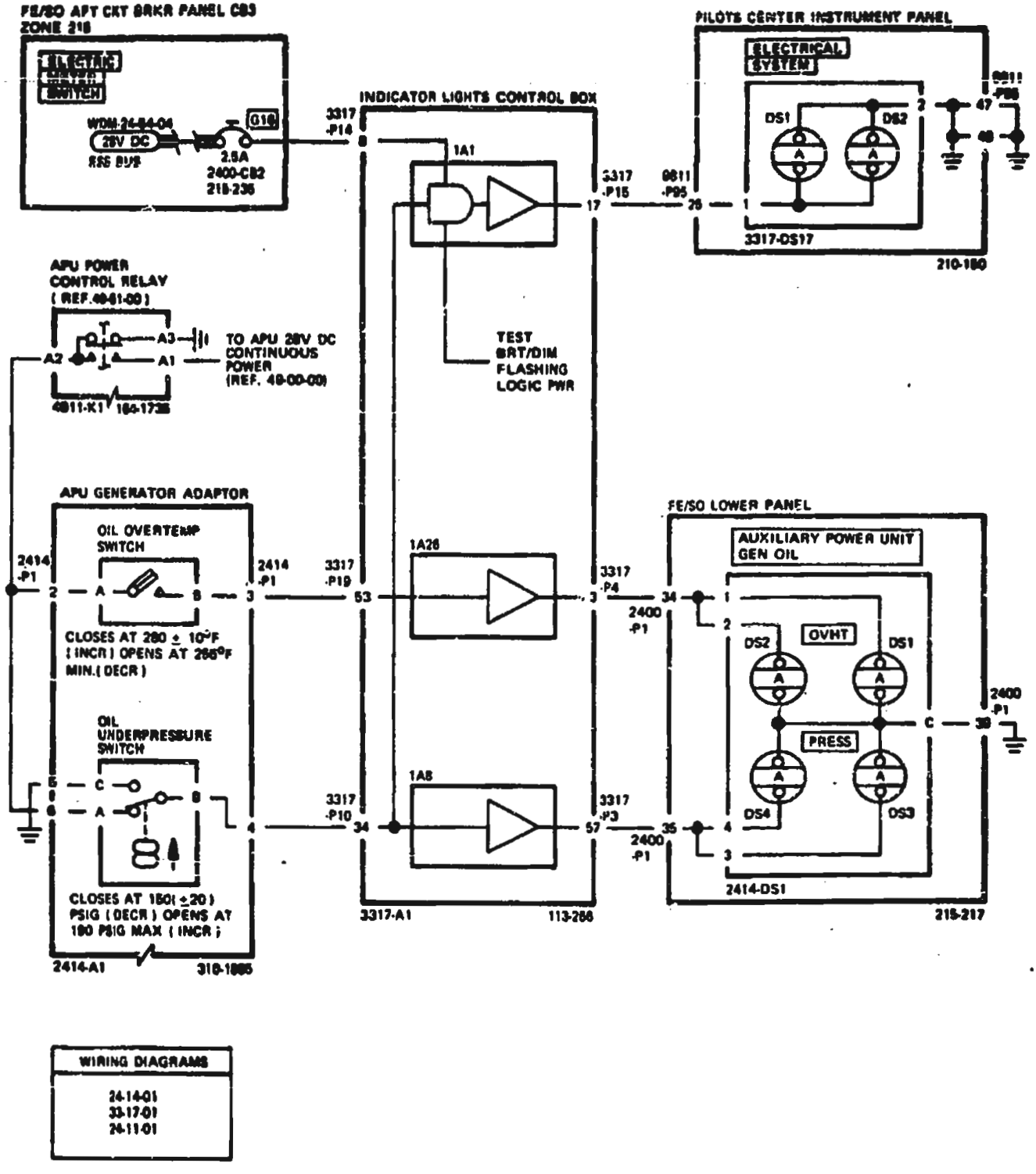
APU Generator Oil OVHT (Overheat) Fault Isolation
Figure 104 (Sheet 2)



WIRING DIAGRAMS
24-14-01
33-17-01
24-11-01

EM1-0107-24-038

APU Generator Oil Underpressure and Overheat Schematic
SCHEM 1



WIRING DIAGRAMS
24-14-01
33-17-01
24-11-01

EM1-8000-24-8019

APU Generator Oil Underpressure and Overheat Schematic
SCHEM 1

APU ADAPTER OIL FILTER ELEMENT - REMOVAL AND INSTALLATION

1. Equipment and Materials

Container (2 quarts, minimum)

Lubricant, Acryloid, HF825, Rohm and Haas, or equivalent

O-rings (Ref. Fig. 401)

R R Filter Element, Bendix Corp, Purolator, or equivalent (Ref. Fig. 401).

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-24-00 APU Generator System - Servicing

49-00-01 Auxiliary Power Unit (APU) - Adjustment and Test

3. Removal/Installation

A. Removal

(1) Open APU compartment access doors 319AL and 319CL on left side of compartment.

R R CAUTION: IF FILTER ELEMENT IS BEING REPLACED, VERIFY THAT NEW ELEMENT IS AN EXACT REPLACEMENT.

(2) Position container under filter and remove filter by turning counterclockwise.

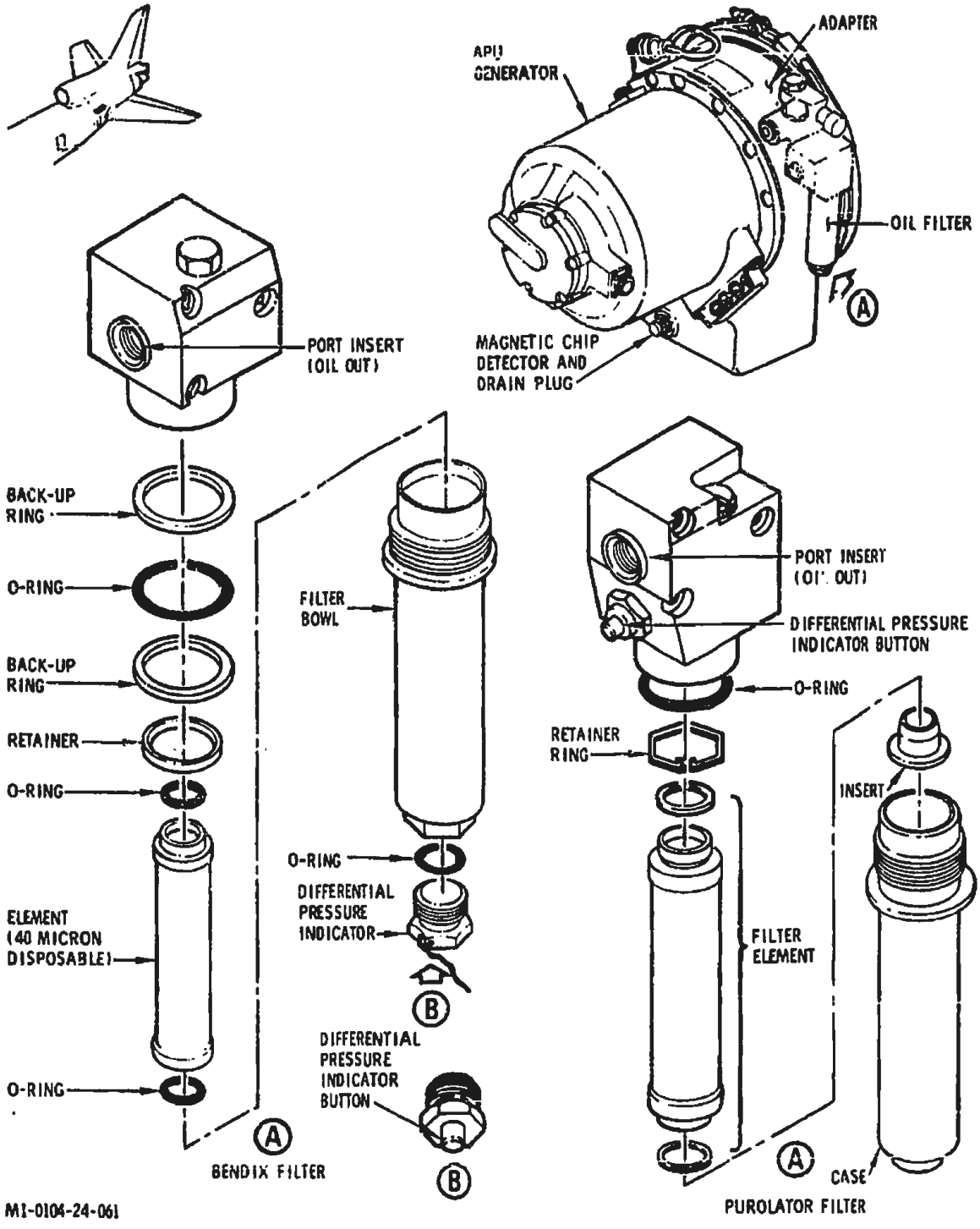
(3) Remove filter from bowl and inspect. Replace filter element and O-rings as necessary.

B. Installation

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED TO LUBRICATE O-RINGS.

(1) Clean mating surfaces with a lint-free cloth and install new O-rings (Ref. Fig. 401).

(2) Install filter bowl and torque 8 to 10 lb ft. Wipe bowl and adjacent area clean. Install lock-wire.



R APU Adapter Oil Filter Element - Removal and Installation
R Figure 401

(3) Start APU (Ref. 49-00-01) and check for oil leaks. Shutdown APU.

(4) Ensure that oil is at correct level on sight glass. Replenish as necessary (Ref. 24-24-00).

(5) Close and secure access doors.

APU ADAPTER OIL OVERTEMPERATURE SWITCH REMOVAL AND INSTALLATION

1. Equipment and Materials

R Container (2 quarts, minimum)

R Lubricant, Acryloid, HF825, Rohm and Haas, or equivalent

O-ring (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-24-00 APU Generator System - Servicing

R 49-00-01 Auxiliary Power Unit (APU) - Adjustment and Test

3. Removal/Installation

A. Removal

(1) Open APU access doors 319AL and 319CL on left side of compartment.

(2) Remove electrical connector from overtemperature switch (Ref. Fig. 401).

(3) Position container under switch and remove switch by turning counterclockwise.

B. Installation

(1) Clean switch and area with lint-free cloth.

R R (2) Lubricate O-ring with Acryloid or equivalent and install on switch (Ref. Fig. 401).

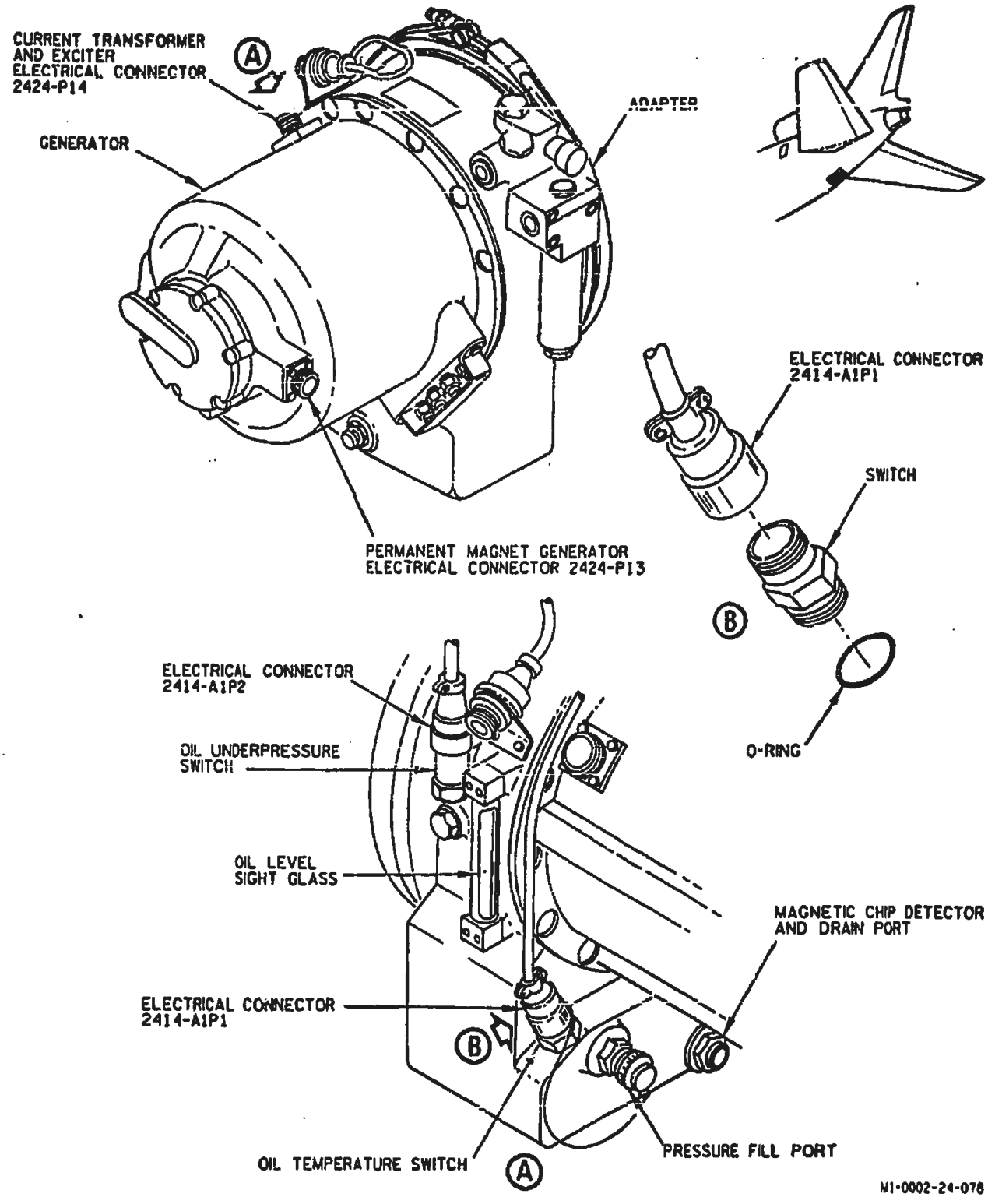
(3) Install switch in adapter, torque 8 to 10 lb ft, and lock-wire.

(4) Install electrical connector.

(5) Ensure that oil is at correct level on oil level sight glass. Replenish as necessary (Ref. 24-24-00).

(6) Start APU (Ref. 49-00-01) and check for oil leaks. Shut down APU.

(7) Close and secure access doors.



R APU Adapter Oil Overtemperature Switch - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B

APU ADAPTER OIL UNDERPRESSURE SWITCH - REMOVAL AND INSTALLATION

1. Equipment and Materials

Container (2 quarts, minimum)

R Lubricant, Acryloid, HF825, Rohm and Haas, or equivalent

O-ring (Ref. Fig. 401)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-24-00 APU Generator System - Servicing

R 49-00-01 Auxiliary Power Unit (APU) - Adjustment and Test

3. Removal/Installation

A. Removal

(1) Open APU access doors 319AL and 319CL on left side of compartment.

(2) Remove electrical connector from underpressure switch (Ref. Fig. 401).

(3) Position container under switch and remove switch by turning counterclockwise.

B. Installation

(1) Clean switch and area with lint-free cloth.

R (2) Lubricate O-ring with Acryloid or equivalent and
R install on switch (Ref. Fig. 401).

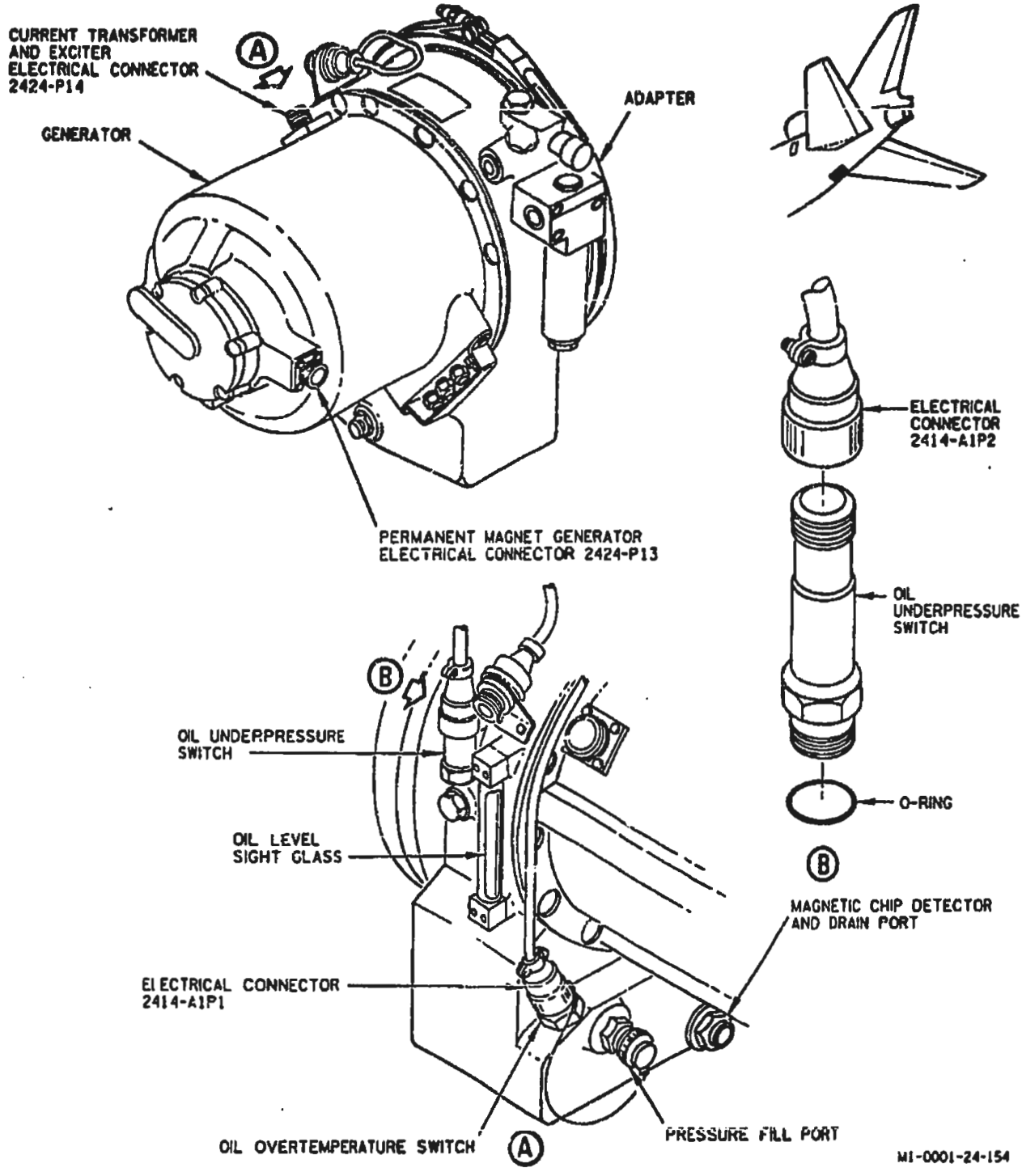
(3) Install switch in adapter, torque 8 to 10 lb ft, and lock-wire.

(4) Install electrical connector and lock-wire.

(5) Ensure that oil is at correct level on oil level sight glass. Replenish as necessary (Ref. 24-24-00).

R (6) Start APU (Ref. 49-00-01) and check for oil leaks.
P Shut down APU.

(7) Close and secure access doors.



R APU Adapter Oil Underpressure Switch - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

APU ADAPTER FILTERED VACUUM RELIEF VALVE REMOVAL AND INSTALLATION

1. Equipment and Materials

R Lubricant, Acryloid, HF825, Rohm and Haas, or equivalent

O-ring NAS1595-4, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

24-14-04	APU Adapter Underpressure Switch - Removal and Installation
R 49-00-01	Auxiliary Power Unit (APU) - Adjustment and Test

3. Removal/Installation

A. Removal

(1) Open access doors 319AL and 319CL on left side of APU compartment.

(2) Remove oil underpressure switch (Ref. 24-14-04) to gain access to relief valve (Ref. Fig. 401).

(3) Remove relief valve by turning counterclockwise.

B. Installation

R R (1) Lubricate new O-ring with Acryloid or equivalent and install on relief valve.

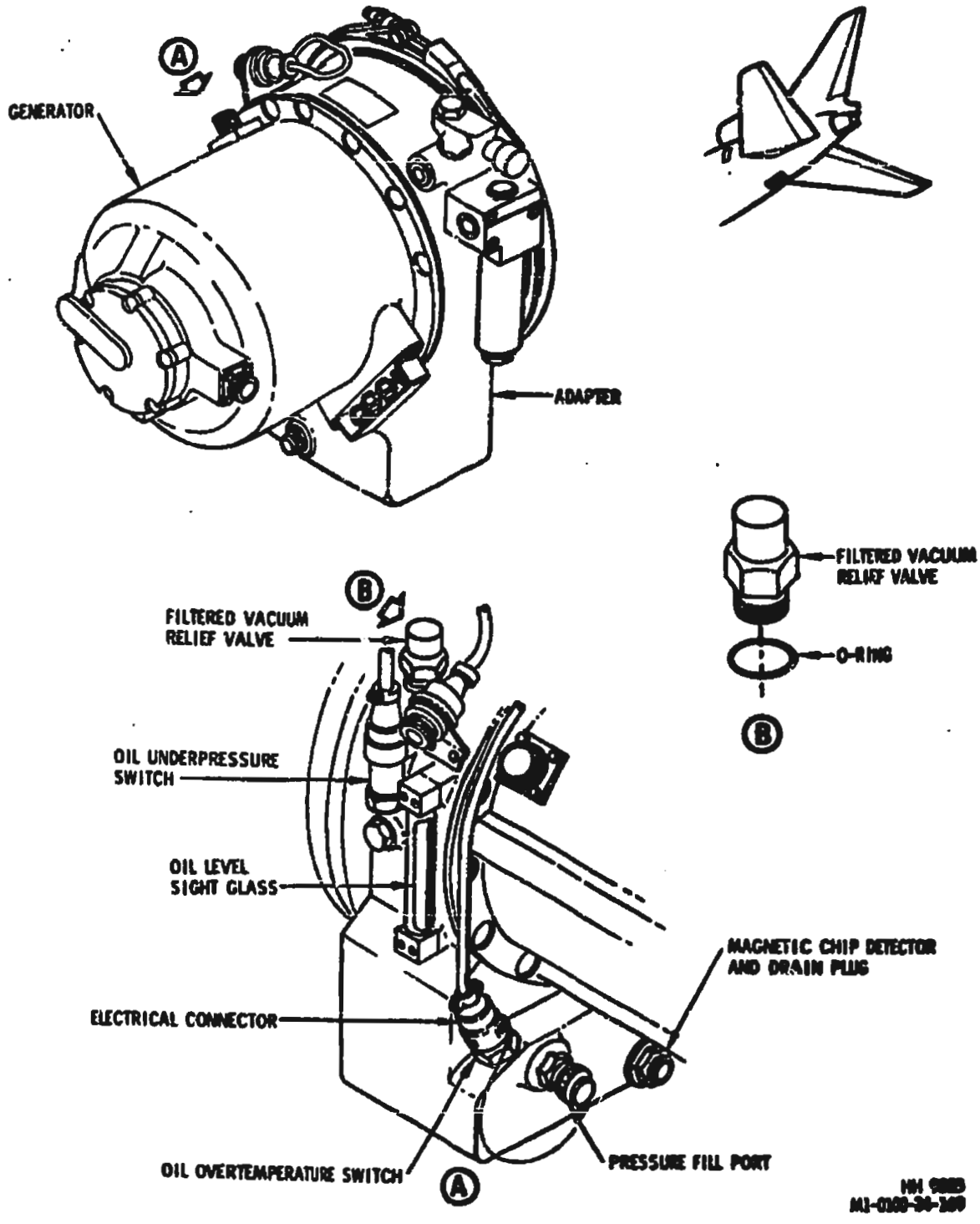
(2) Install valve in adapter and torque 10 to 12 lb in.

(3) Install lock-wire.

(4) Install underpressure switch (Ref. 24-14-04).

R R (5) Start APU (Ref. 49-00-01) and check for oil leaks. Repair leaks and recheck.

(6) Close and secure access doors.



R
R
R

APU Adapter Filtered Vacuum Relief Valve
Removal and Installation
Figure 401

AC GENERATION - DESCRIPTION AND OPERATION

All ac power is generated by four 90-kVA generators. Three generators are engine-driven through integrated drive generator (IDG) transmissions, the fourth is driven by the auxiliary power unit (APU) through an adapter assembly. All generators are regulated to 117/208 volts, 400 Hz. The three engine-driven generators are normally paralleled on the bus system. The APU generator can be paralleled with the engine-driven generators if required.

Each generator is monitored and controlled by a solid-state generator control unit (GCU). The GCU contains circuits which monitor the generator output for frequency, voltage, and phase rotation. If the output is correct, other GCU circuits monitor the bus system for correct voltage, frequency, and phase agreement between buses and generator output. If the bus is not energized, or if it is correctly energized and proper in-phase condition exists, the GCU energizes the proper relays to connect the generator to the bus.

If any undesired condition of the generator output exists, such as underfrequency, overvoltage, undervoltage, overexcitation or underexcitation, or if feeder faults exist, the GCU removes the generator from the bus system (Ref. 24-51-00) and deenergizes the generator, if necessary.

Normally, generator control is completely automatic. Monitoring of the operation is provided by indicator lights and meters on the Flight Engineer/Second Officers (FE/SO) ELECTRICAL control panel, zone 215. The automatic control system can be manually overridden by control switches to deenergize any generator or bus. In many cases the indicator light and associated control switch are combined into a single pushbutton unit (switchlight).

A real load controller for each engine-driven generator senses the total kW load on its associated generator during parallel operation, and controls the generator output so that it carries its share of the real load. If any generator begins to carry more or less than its share, the controller varies the output torque of the generator transmission until it is again carrying the proper load.

AC GENERATION - ADJUSTMENT AND TEST

1. General

These procedures are performed to verify proper operation of the ac generation system and to provide tests for the generator overload circuit and the fire handle shutdown circuits. If abnormal conditions are encountered during the procedure, appropriate fault isolation procedures should be initiated.

2. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
6-50-00	Interior Access Doors and Removable Panels - Description and Operation
24-41-00	External Power/Ground Service System - Maintenance Practices
26-21-00	Engine/APU Fire Extinguishing System - Description and Operation
49-00-01	Auxiliary Power Unit (APU) - Adjustment and Test
71-00-00	Power Plant - Adjustment and Test

3. Adjustment/Test

A. Operational Test

R (1) Turn on external electrical power (Ref. 24-41-00). Place EXT PWR switch (on ELECTRICAL panel) in ON position.

(2) On pilots overhead circuit breaker panel CB1, zone 210, verify the following circuit breakers are closed:

ELEC BUS CONT

AC STBY BUS SENSE (K10)

AC ESS BUS CONT (K11)

DC STBY IND (K13)

GEN CONTROL UNITS

GEN 1 (K15)

GEN 2 (K16)

GEN 3 (K17)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify the following circuit breakers are closed:

DC POWER

TIE BUS CONT

BUS 1 (A9)

BUS 2 (A10)

BUS 3 (A11)

TIE BUS PWR

BUS 1 (A12)

BUS 2 (A13)

BUS 3 (A14)

R BAT CHG (A15)

R BUS 3 GALLEY PWR (A16)

R GND SVCE GALLEY EXT (A17)

APU POWER

BAT PWR (B10)

APU T/R PWR (B11)

APU GEN CONT UNIT (B17)

AC POWER

LOAD CONT & FAIL IND

BUS 1 (D10)

BUS 2 (D13)

BUS 3 (D16)

FLIGHT STA PWR

BUS 1 (E9)

BUS 2 (E10)

BUS 3 (E11)

ESS POWER

GEN 1 (E12)

GEN 2 (E13)

BUS 3 (E14)

T/R POWER

1 (E16)

2 (E17)

3 (E18)

DC ESS BUS

DC STBY PWR (F1)

DC TIE BUS

CONT (F2)

PWR (F3)

AC STBY BUS PWR (F12)

BUS SENSING AC ESS (F14)

ESS T/R PWR (F17)

IND LT

AC BUS IND (G11)

DC AUTO XFR (G13)

GEN OVERLOAD PROTECT (G14)

IDG DISC (G15)

ELECTRIC METER SWITCH (G16)

IDG OIL

LOW PRESS (AA17)

TEMP (AA18)

(3) Verify that all three TIE BREAKER - CLOSE switchlights (bar lights) are on.

NOTE: If any light is not on, and its associated TRIP switchlight indicates OPEN, press CLOSE switchlight to close tie breaker.

NOTE: The following indicator panel is located in Mid Electrical Service Center (MESC), zone 137.

R (4) Gain access to MESC, zone 137, (Ref. 6-40-00, 6-50-00)
R and locate GENERATOR SYSTEM FAILURE panel (Ref.
R 24-20-01 Fig. 102).

(5) Start engines (Ref. 71-00-00) and APU (Ref. 49-00-01).

NOTE: The following lights and indicators are located on Flight Engineer/Second Officers ELECTRICAL control panel, zone 215.

(6) Operate each engine at idle RPM (APU at 100 percent) and verify that the three IDG DISCONNECT - LOW PRESS and the AUXILIARY POWER UNIT - GEN OIL - PRESS lights are off. Verify a gradual upscale reading on each of the three IDG OIL TEMP indicators.

(7) Verify that all four GENERATOR FIELD - CLOSE switchlights (bar lights) are on.

NOTE: If any light is not on, and its associated TRIP switchlight indicates OPEN, press CLOSE switchlight to energize generator field.

(8) Verify that all four GENERATOR BREAKER - CLOSE switchlights (bar lights) are on.

NOTE: If any light is not on, and its associated TRIP switchlight indicates OPEN, press GENERATOR BREAKER - CLOSE.

(9) Verify that all three TIE BREAKER switchlights (barlights) have gone off and that associated TRIP switchlights are on.

(10) Verify that all diode indicators are displayed black on Generator System Failure annunciator panel.

(11) Place EXT PWR switch in OFF position. Verify that all three TIE BREAKER switchlights (barlights) come on and that associated TRIP switchlights are off.

(12) Select generator No. 1, 2, 3, and the APU generator in order by rotating the volts/frequency selector switch. Verify that each generator output is 115-119V ac at a frequency of 396-404 Hz.

(13) Verify that no TIE BREAKER - TRIP switchlight indicates
R OPEN while accomplishing Steps (11) and(12).

(14) Press No. 1 GENERATOR FIELD - TRIP switchlight and verify that No. 1 GENERATOR FIELD - TRIP and No. 1 GENERATOR BREAKER - TRIP switchlights indicate OPEN. Verify that associated GENERATOR FIELD - CLOSE and GENERATOR BREAKER - CLOSE switchlights go off.

(15) Press No. 1 GENERATOR FIELD - CLOSE switchlight and verify that integral bar light comes on and that adjacent TRIP OPEN switchlight goes off.

(16) Verify that No. 1 GENERATOR BREAKER - CLOSE barlight comes on and that No. 1 TRIP OPEN switchlight goes off.

(17) Repeat Steps (14), (15), and (16) for generators No. 2 and 3, and for APU generator; verify similar results.

(18) Rotate ac essential bus selector switch from NORM B3(G1) to B3, G1, and G2 (MANUAL) positions. Verify that AC ESS BUS - FAIL light remains off. Return switch to NORM B3(G1) position.

(19) Place EXT PWR switch (on ELECTRICAL panel) in ON position. Verify that all three TIE BREAKER - TRIP switchlights and the AUXILIARY POWER UNIT - GENERATOR BREAKER - TRIP switchlight indicate OPEN.

(20) Shut down engines (Ref. 71-00-00). Verify that associated GENERATOR FIELD (bar lights) and GENERATOR BREAKER - CLOSE switchlights go off, and corresponding TRIP switchlights indicate OPEN.

(21) As each engine is shutdown, verify that corresponding TIE BREAKER - TRIP switchlight goes off and corresponding TIE BREAKER - CLOSE (bar) switchlight comes on.

(22) Place EXT PWR switch in OFF position, and verify that AUXILIARY POWER UNIT - GENERATOR BREAKER - TRIP switchlight goes off and its associated CLOSE (bar)

switchlight comes on signifying APU generator takeover of the ac bus system.

(23) Shut down APU (Ref. 49-00-01).

R (24) Turn off external electrical power (Ref. 24-41-00).

B. Generator Overload Circuit Test

(1) Turn on electrical power (Ref. 24-41-00).

(2) Place one or more GALLEY POWER switchlights on ELECTRICAL panel, zone 215, in on (latched in) position and verify that OFF light goes off.

(3) Enter mid electrical service center (Ref. 6-40-00, 6-50-00).

WARNING: WHEN GAINING ACCESS TO THE RIGHT HAND RACK BY PASSING BETWEEN THE LADDER AND THE AFT BULKHEAD, IT IS POSSIBLE TO ACCIDENTLY PRESS THE MOMENTARY
R CONTACT SWITCHES FOR THE GENERATOR SELF TEST, LOCATED ON THE AFT BULKHEAD. INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE SELF TEST SWITCH. WHEN THE SELF TEST SWITCH IS PRESSED, THE GENERATOR OVERLOAD RELAY ENERGIZES FOR A CHECK OF THE LOAD-SHEDDING CIRCUITS. IF THE GALLEY POWER CIRCUITS AND/OR THE AC HYDRAULIC PUMP CIRCUITS ARE ENERGIZED, THESE CIRCUITS WILL DEENERGIZE AND LOCK OUT UNTIL THEIR RESPECTIVE CONTROL SWITCHES ARE PLACED IN THE OFF POSITION.

R WARNING: WHEN ENTERING, EXITING AND WORKING ON OR NEAR THE INNER ACCESS DOOR, USE CARE NOT TO DAMAGE THE DOOR PROXIMITY SENSOR SWITCH. THIS DOOR IS PRESSURE SEALED AND CARE MUST BE TAKEN IN ITS OPERATION.

R INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN
R OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED
R FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL
R SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE
R SELF TEST SWITCH.

(4) On GENERATOR SYSTEM FAILURE panel, momentarily press SELF TEST switch. Verify that OFF light in each depressed GALLEY POWER switchlight comes on.

(5) Release each GALLEY POWER switchlight and verify that OFF lights stay on.

(6) Restore galley power by placing GALLEY POWER switchlights in on (latched in) position. Verify that OFF light in each switchlight goes off.

(7) Turn off electrical power (Ref. 24-41-00).

C. IDG Disconnect - Engine/APU Fire Extinguisher Control Handle Test

(1) Turn on electrical power (Ref. 24-41-00).

CAUTION: ACTUATING THE FIRE EXTINGUISHER DISCHARGE SWITCH LOCATED BEHIND THE ENGINE/APU FIRE EXTINGUISHER CONTROL HANDLE OR ROTATING THE FIRE EXTINGUISHER CONTROL HANDLE ON THE APU EXTERNAL CONTROL PANEL WILL DISCHARGE THE FIRE EXTINGUIHSER CONTAINERS (REF. MM26-21-00) TO PREVENT INADVERTENT DISCHARGE OF THE CONTAINERS OPEN THE FOLLOWING CIRCUIT BREAKERS:

(2) On pilots overhead circuit breaker panel FB1, open and tag the following FIRE EXTINGUISHER circuit breakers.

ENG 1 - MAIN (C10)

ENG 1 - ALT (C11)

ENG 2 - MAIN (C12)

ENG 2 - ALT (C13)

ENG 3 - MAIN (C14)

ENG 3 - ALT (C15)

APU - MAIN (C16)

APU - ALT (C17)

(3) On pilots overhead panel, pull fire extinguisher control handle for main engine generator being tested or pull APU fire extinguisher control handle on Flight Engineer/Second Officers upper panel; or pull down the fire extinguisher control handle on the APU external control panel, Zone 142 (Ref. Figure 501).

(4) Remove applicable GCU and check for continuity between pins 9 and 32 of GCU connectors, 2421-J1B (Gen 1), -J13B (Gen 2), -J24B (Gen 3) or 2424-J1B (APU) as applicable.

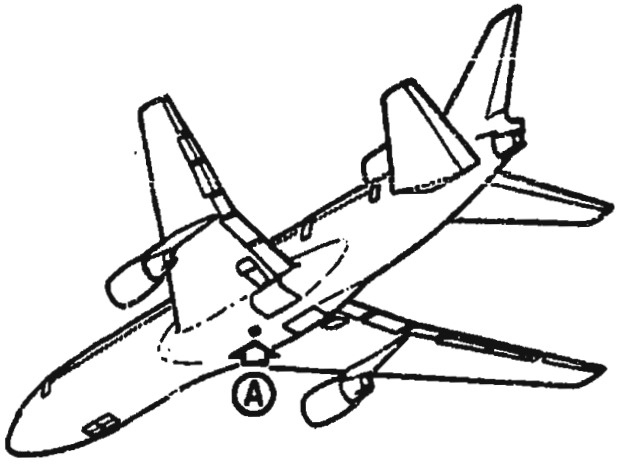
(5) Push in fire extinguihser control handle to be tested and verify that no continuity exists between pins 9 and 32 of the GCU connector.

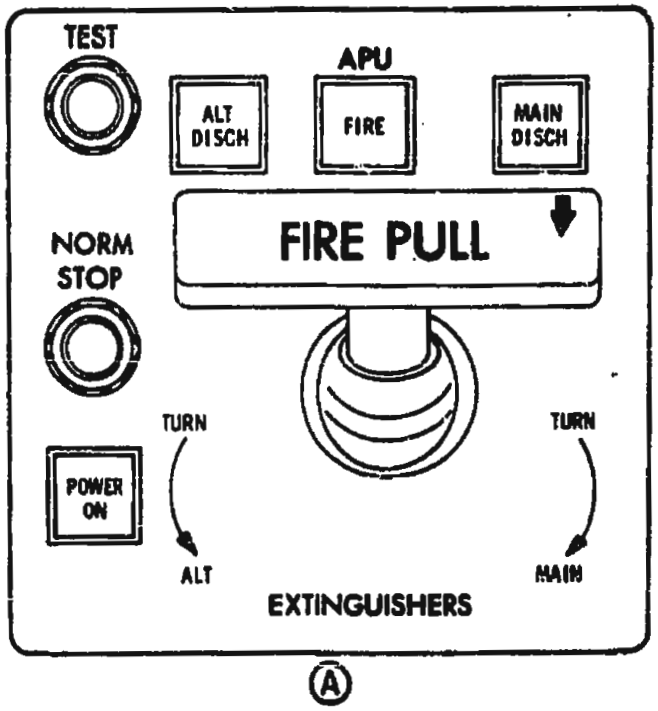
(6) Reinstall GCU.

(7) Remove tags and close circuit breakers opened in Step 3C(2).

(8) Verify that Flight Engineer/Second Officers ELECTRICAL panel indicators remained as described in Steps 3A(16) thru 3A(18).

(9) Turn off electrical power (Ref. 24-41-00).





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R APU External Control Panel
R Figure 501

R EFFECTIVITY: ALL
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001B

GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL - FAULT ISOLATION

1. General

R Diagrams and schematics in this section can be used for fault
R isolation any time a fault is reported or suspected.
R PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 24 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

R Table 101 lists fault isolation diagrams and schematics in this section.

Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Generator System Failure Annunciator Panel Fault Isolation
SCHEM 1	Generator System Failure Annunciator Panel Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
CONTROLLER – REAL LOAD DIVISION			
NO. 1	1	MESC/192K, 137AZ	24-11-11
NO. 2	1	MESC/192K, 137AZ	24-11-11
NO. 3	1	MESC/192K, 137AZ	24-11-11
CONTROL UNIT			
GEN NO. 1	1	MESC/192K, 137AZ	24-21-05
GEN NO. 2	1	MESC/192K, 137AZ	24-21-05
GEN NO. 3	1	MESC/192K, 137AZ	24-21-05
APU	1	MESC/192K, 137AZ	24-21-05
PANEL – BUS PROTECTION	1	MESC/192K, 137AZ	24-20-03
PANEL – GENERATOR SYSTEM FAILURE ANNUNCIATOR	1	MESC/192K, 137AZ	24-20-01

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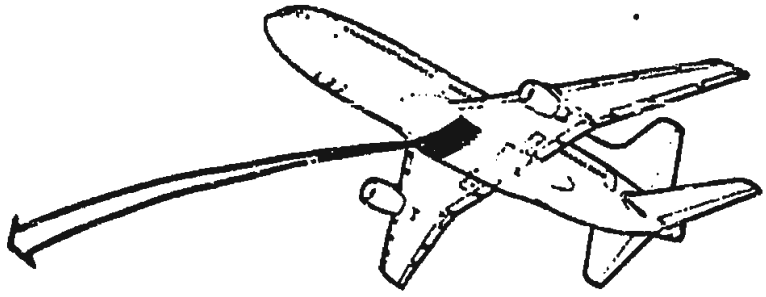
R
R

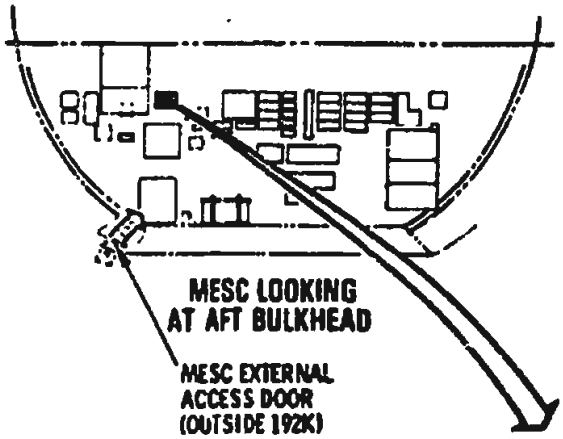
Component Location Index
Figure 101

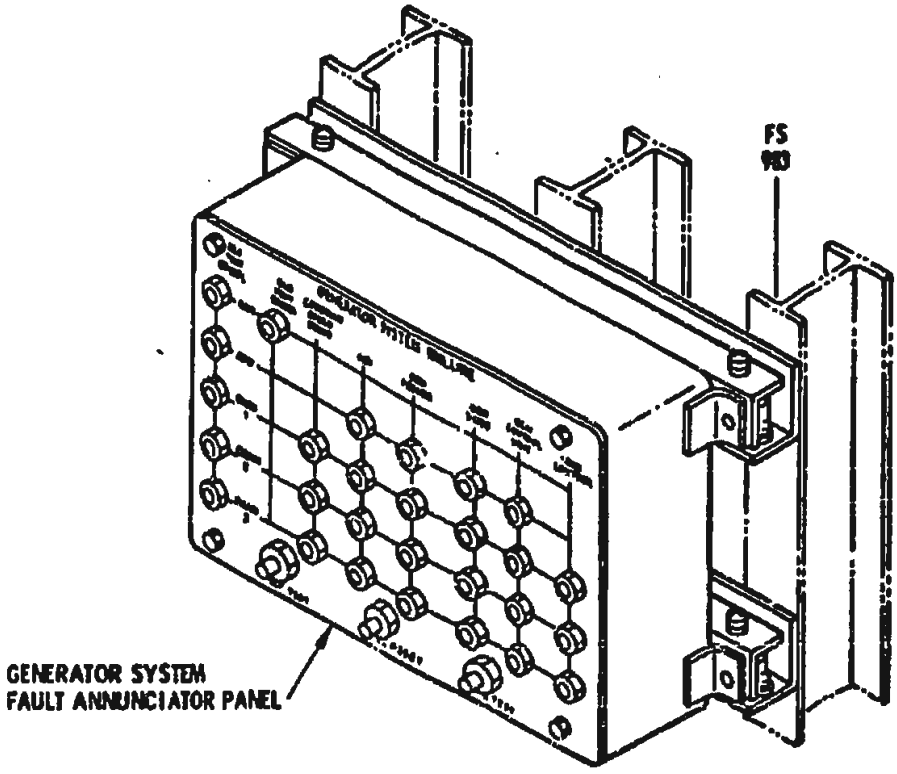
EFFECTIVITY: ALL

001B



ZONE 137





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Component Locator Diagram
Figure 102 (Sheet 1)

R EFFECTIVITY: ALL
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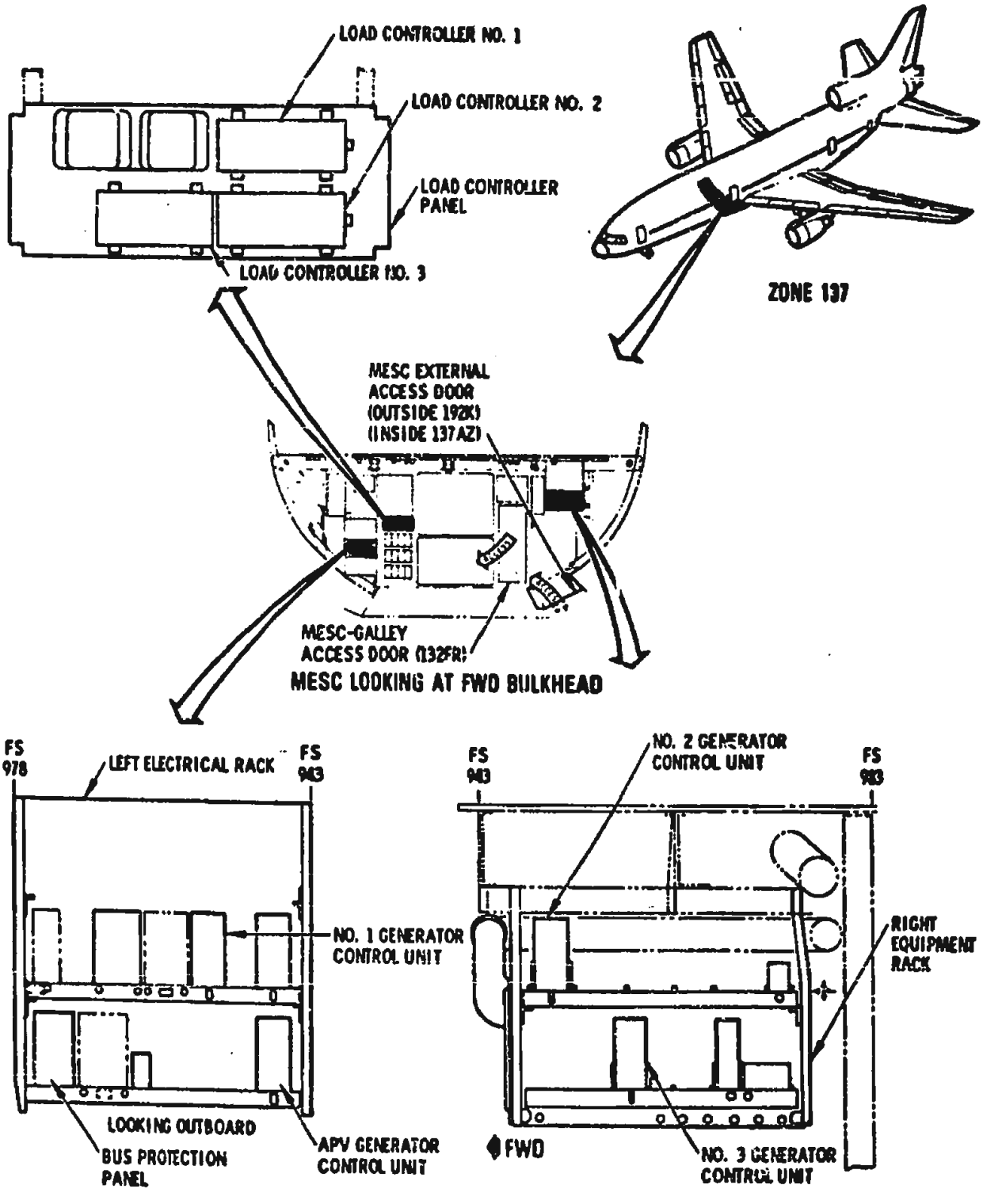

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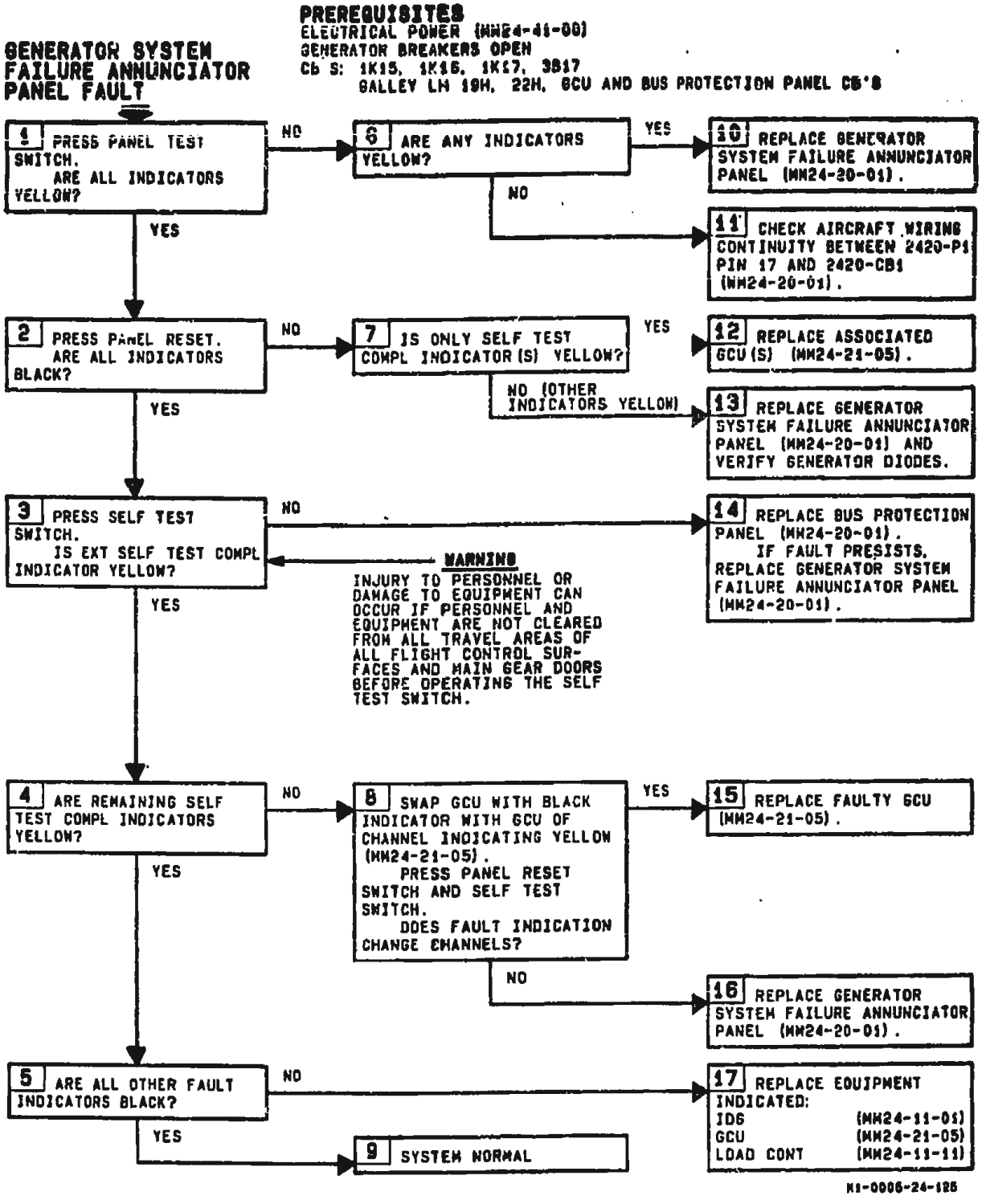
R R Component Locator Diagram
Figure 102 (Sheet 2)

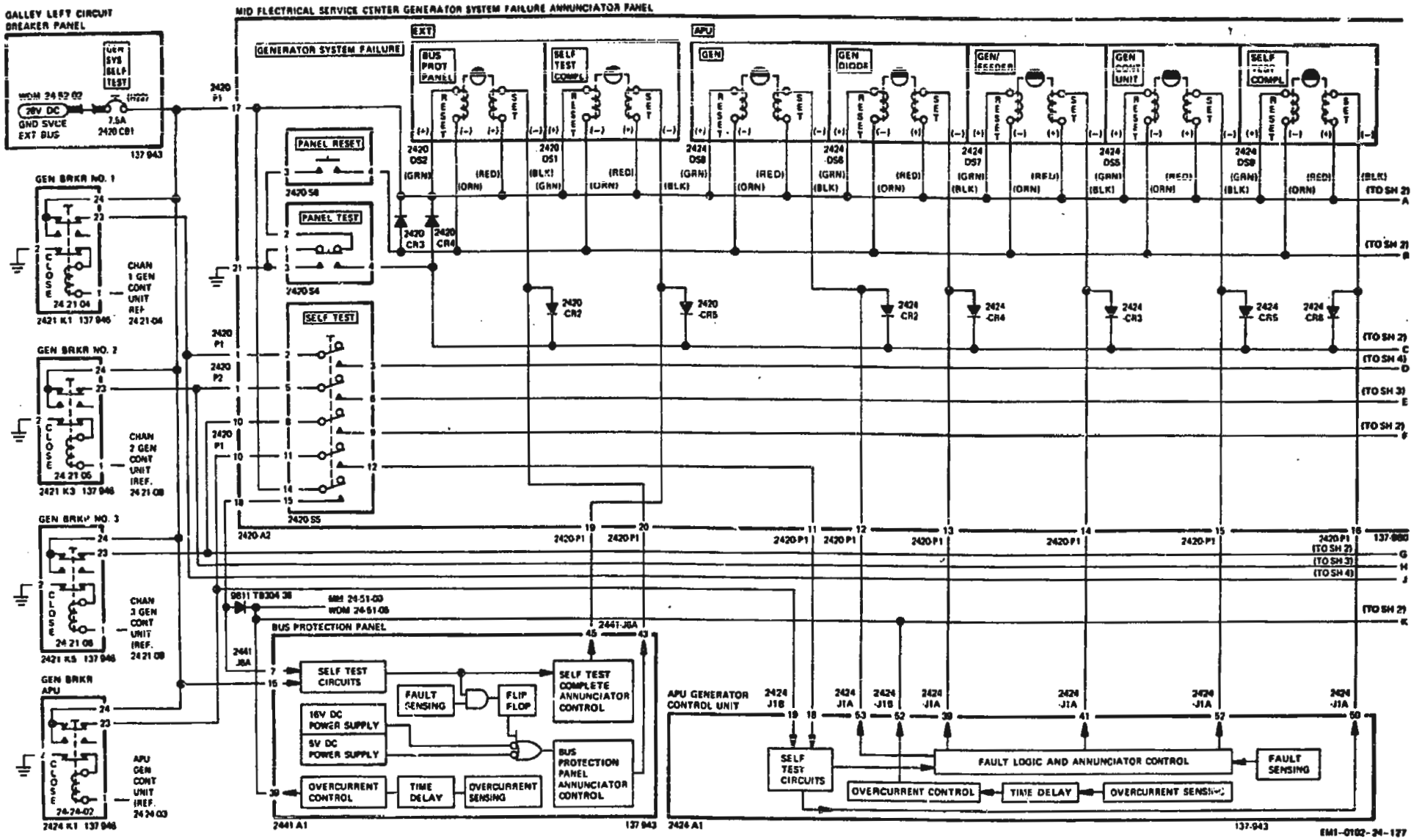
R R 0018 EFFECTIVITY: ALL


GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL FAULT
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
GENERATOR BREAKERS OPEN
CB S: 1K15, 1K16, 1K17, 3B17
GALLEY LH 19H, 22H, GCU AND BUS PROTECTION PANEL CB'S
1 PRESS PANEL TEST SWITCH. ARE ALL INDICATORS YELLOW?
NO
6 ARE ANY INDICATORS YELLOW?
YES
10 REPLACE GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL (MM24-20-01).
NO
11 CHECK AIRCRAFT WIRING CONTINUITY BETWEEN 2420-P1 PIN 17 AND 2420-CB1 (MM24-20-01).
YES
2 PRESS PANEL RESET. ARE ALL INDICATORS BLACK?
NO
7 IS ONLY SELF TEST COMPL INDICATOR(S) YELLOW?
YES
12 REPLACE ASSOCIATED GCU(S) (MM24-21-05).
NO (OTHER INDICATORS YELLOW)
13 REPLACE GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL (MM24-20-01) AND VERIFY GENERATOR DIODES.
YES
3 PRESS SELF TEST SWITCH. IS EXT SELF TEST COMPL INDICATOR YELLOW?
NO
14 REPLACE BUS PROTECTION PANEL (MM24-20-01). IF FAULT PRESISTS, REPLACE GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL (MM24-20-01).
WARNING
INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE SELF TEST SWITCH.
YES
4 ARE REMAINING SELF TEST COMPL INDICATORS YELLOW?
NO
8 SWAP GCU WITH BLACK INDICATOR WITH GCU OF CHANNEL INDICATING YELLOW (MM24-21-05). PRESS PANEL RESET SWITCH AND SELF TEST SWITCH. DOES FAULT INDICATION CHANGE CHANNELS?
YES
15 REPLACE FAULTY GCU (MM24-21-05).
NO
16 REPLACE GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL (MM24-20-01).
YES
5 ARE ALL OTHER FAULT INDICATORS BLACK?
NO
17 REPLACE EQUIPMENT INDICATED:
IDG (MM24-11-01)
GCU (MM24-21-05)
LOAD CONT (MM24-11-11)
YES
9 SYSTEM NORMAL
M1-0006-24-125

R Generator System Failure Annunciator Panel Fault Isolation
R Figure 103

EFFECTIVITY: ALL

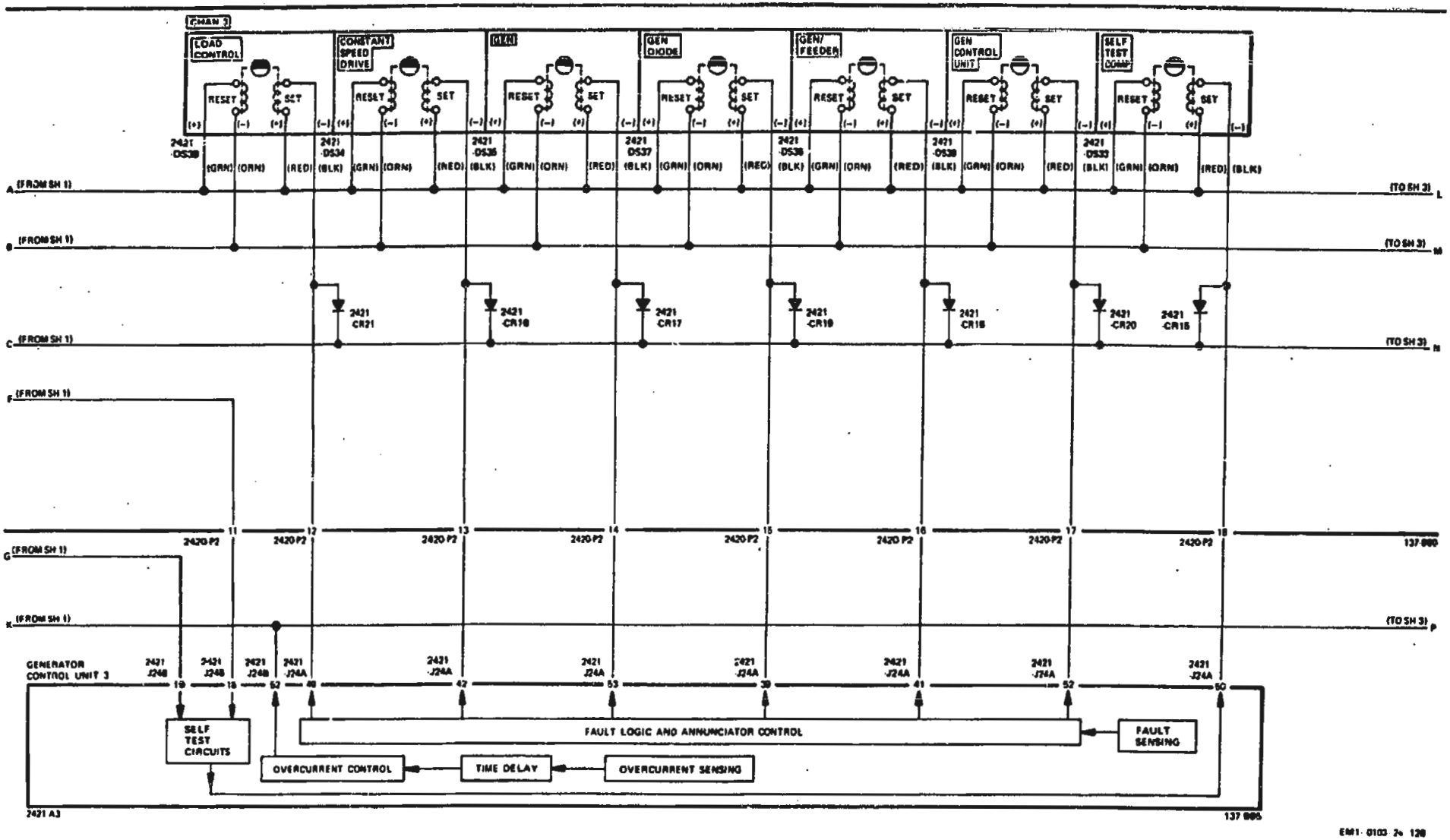
001B



Generator System Failure Annunciator Panel Schematic
SCHEM 1 (Sheet 1)

EFFECTIVITY: ALL

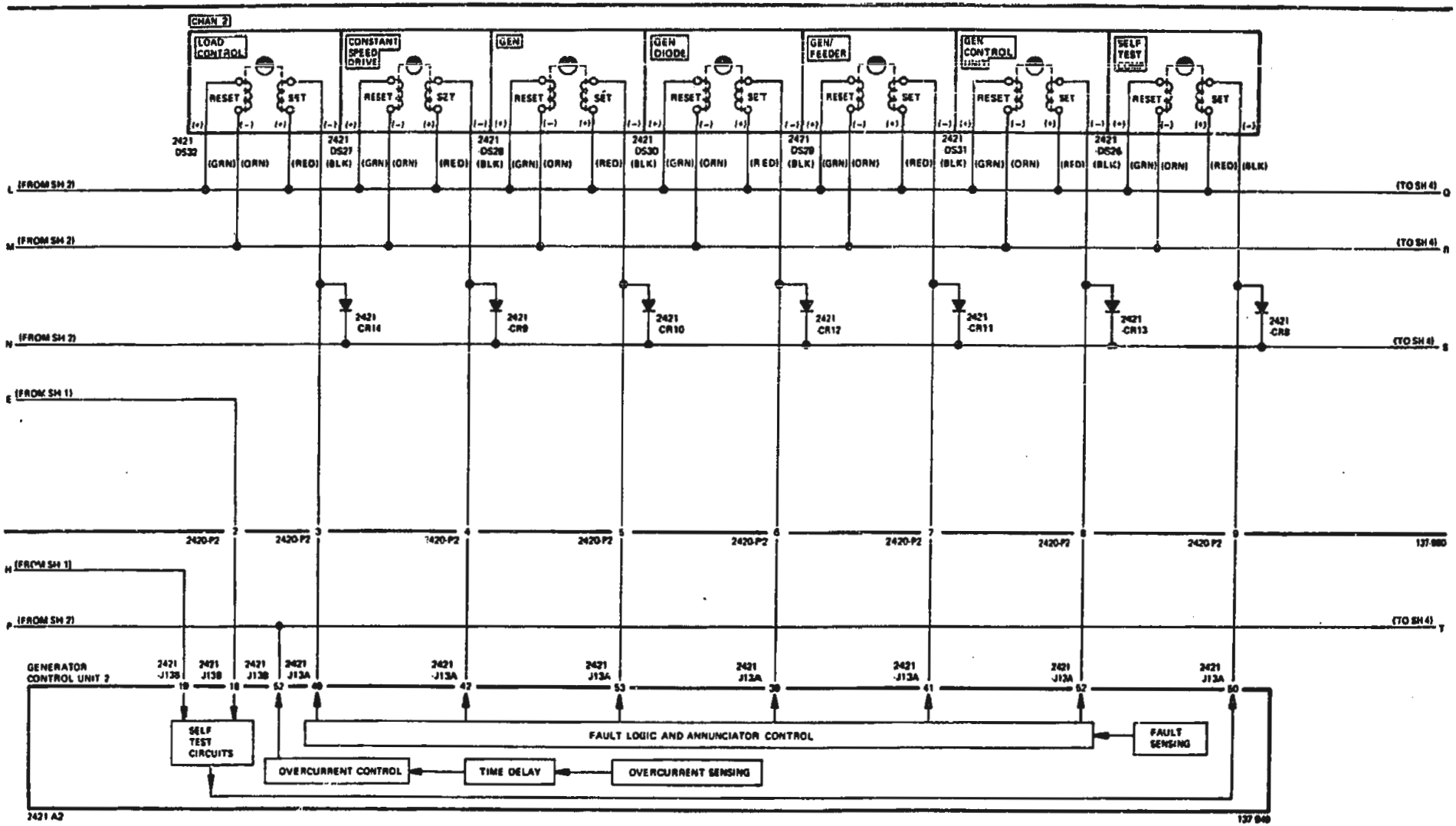
001B



R Generator System Failure Annunciator Panel Schematic
R SCHEM 1 (Sheet 2)

EFFECTIVITY: ALL

001B



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R Generator System Failure Annunciator Panel Schematic
R SCHEM 1 (Sheet 3)

EFFECTIVITY: ALL

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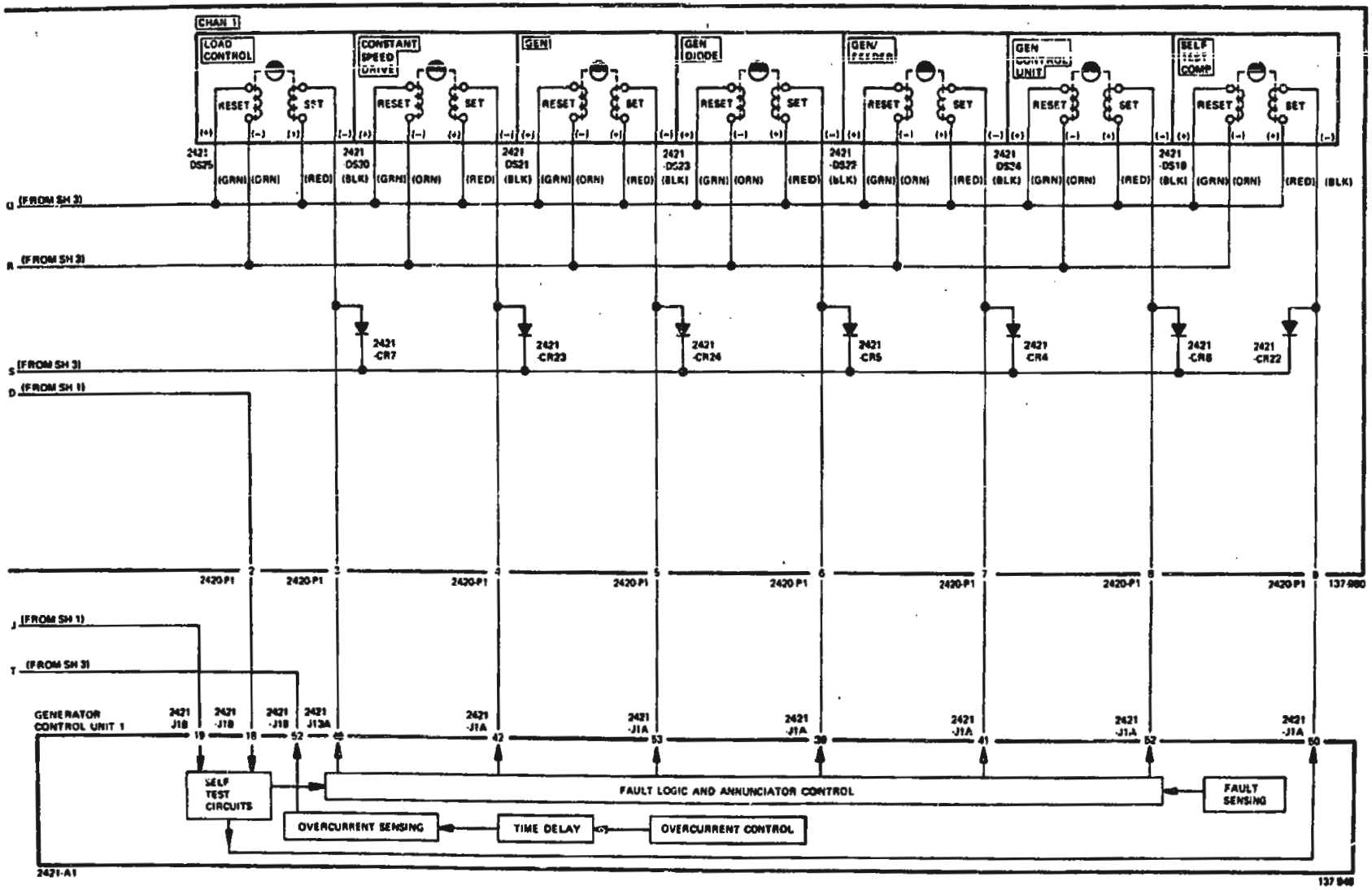


WIRING DIAGRAMS
24-21-07
24-20-01
24-21-04
24-21-05
24-21-06
24-21-07
24-21-08
24-21-01
24-21-02
24-21-03

EM1-0101-24-239

R Generator System Failure Annunciator Panel Schematic
R SCHEM 1 (Sheet 4)

EFFECTIVITY: 001-031

001B

GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL REMOVAL AND INSTALLATION

R 1. Referenced Procedures

R	6-40-00	Exterior Access Doors and Removable Panels -
R		Description and Operation
R	6-50-00	Interior Access Doors and Removable Panels -
R		Description and Operation
R	24-51-00	AC Bus System

R 2. Removal/Installation

A. Removal

(1) On galley left circuit breaker panel, zone 130, open and tag GEN SYS SELF TEST circuit breaker.

R (2) Enter mid electrical service center, zone 137 (Ref.
R 6-40-00, 6-50-00).

(3) Disconnect electrical connectors on left end of generator system failure annunciator panel.

(4) Remove nuts, washers, and screws from panel assembly mounting clips.

B. Installation

(1) Verify that circuit breaker opened in Step A(1) is open and tagged.

(2) Position panel assembly, install and tighten screws, washers, and nuts in panel mounting clips.

(3) Install electrical connectors.

(4) Remove tag and close circuit breaker opened in Step A(1).

(5) Perform the following panel operational check:

(a) Press PANEL TEST switch. All indicators must turn yellow.

(b) Press PANEL RESET switch. All indicators must turn black.

WARNING: INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE SELF TEST SWITCH.

(c) Press SELF TEST switch. Within 10 to 15 seconds all SELF TEST COMPL indicators must turn yellow, and all others must remain black.

R

NOTE: When SELF TEST switch is pressed, generator overload and ac motor pump monitor relays (Ref. 24-51-00) are energized.

If proper action does not occur in Steps B(5)(a) and B(5)(b), panel is faulty. If any indicator fails to operate in Step B(5)(c), that system is faulty. Fault-isolate in accordance with applicable procedure.

(6) Reset galley power lockout by placing all three GALLEY POWER switchlights on Flight Engineer/Second Officers electrical control panel, zone 215, to the OFF position, then place them on one at a time.

(7) Reset AC pump lockout by placing both AC PUMPS switchlights on Flight Engineer/Second Officers hydraulic system control panel, zone 137, to the OFF position, then place them on again as desired.

(8) Close and secure access doors.

BUS PROTECTION PANEL - REMOVAL AND INSTALLATION

1. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
6-50-00	Interior Access Doors and Removable Panels - Description and Operation
20-23-02	Rack Mounted ARINC Box Lever Latch - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

R (1) On galley left circuit breaker panel, zone 130, open and tag PNL - BUS PROTECT circuit breaker.

(2) Turn off external power source (Ref. 24-41-00), disconnect source from aircraft receptacle, and tag receptacle.

(3) Enter mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

(4) Release quick-release latch on bus protection panel handle and pull panel out of rack.

NOTE: The bus protection panel is located at the aft end of the left ARINC rack (lower shelf). Panel weighs 6.3 pounds.

B. Installation

(1) Position the bus protection panel in rack and slide outboard until connectors align.

(2) Push panel firmly into position and latch the quick-release hold-in mechanism in panel handle (Ref. 20-23-02).

(3) Ensure both circuit breakers on face of bus protection panel are closed.

(4) Remove tag and close circuit breaker opened in Step 2A(2).

(5) Remove tag from receptacle and apply external power (Ref. 24-41-00).

(6) Press PANEL TEST and then PANEL RESET switches on generator system failure annunciator panel, zone 137. All indicators must turn yellow when PANEL TEST switch is pressed; when PANEL RESET switch is pressed, all indicators must turn black.

R WARNING: INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN
R OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED
R FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL
R SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE
R SELF TEST SWITCH.

(7) Press SELF TEST switch on generator system failure annunciator panel. The EXT SELF TEST COMPL indicator must turn yellow after 10 to 15 seconds, and the BUS PROT PANEL indicator must remain black.

NOTE: If GALLEY POWER switchlights on ELECTRICAL panel, zone 215, are on (latched in) when SELF TEST switch is pressed, the OFF light in each switchlight will come on and remain on until all three switchlights are released (out). This constitutes a functional check of the generator overload relay. The ac motor pump monitor relay (Ref. 24-51-00) will also energize.

(8) Press PANEL RESET switch to reset indicator.

(9) Close and lock access doors, and remove external power.

R ENGINE_DRIVEN_GENERATOR_SYSTEM_-_DESCRIPTION_AND_OPERATION

R 1. General

R Major components for the generator systems are:

R Integrated drive generator (IDG) assembly

R Generator control unit (GCU)

R Bus protection panel (BPP)

R Real load division controller

R Indication system

R Generator control current transformer (GCCT)

R Differential protection current transformer (DPCT)

R Generator breaker (GB)

R Bus Tie breaker (BTB)

R Generator failure annunciator panel

R 2. INTEGRATED_DRIVE_GENERATOR_(IDG)_ASSEMBLY

R A. Description

R The IDG assembly consists of a transmission (Ref. 24-11-00)
R and an ac generator joined in tandem to form a single
R assembly.

R 3. AC_Generator

R A. Description

R All ac generators (three integrated drive and one APU) are
R identical. The generator is rated at 90 kVA, 0.90 to 1.0
R power factor continuous, and 120 kVA, 0.75 to 1.0 power
R factor for 15 seconds, 120/208V, 390 to 410 Hz, three-phase
R at 11,700 to 12,300 rpm. The generator is a brushless unit
R with an integral ac exciter, rotating exciter rectifiers,
R and a permanent magnet generator (PMG). This system
R operates through the GCU.

R Generator excitation and system control power are supplied
R by the PMG. Excitation of the main generator field comes
R from the exciter through the rotating rectifiers.

R The generator includes internally mounted differential
R protection current transformers (DPCT). Generator cooling
R is accomplished by an oil spray system. Oil from the IDG
R transmission (the APU adapter in the case of the APU
R generator) is sprayed on the heat-producing elements. The
R oil absorbs heat and is drawn off by a scavenge pump, passed
R through an oil cooler, and returned to the transmission (or
R adapter) oil reservoir.

R A single ball bearing is provided at the antidrive end of
R the generator. The drive end of the rotor is supported by
R the female output spline of the transmission (or APU
R adapter).

R NOTE: On aircraft with SB24-082 an additional ball bearing
R is provided at the drive end of the generator.

R B. Operation

R With the generator turning, an ac voltage is produced in the
R PMG stator windings (Ref. Fig. 1). The voltage is connected
R to the generator control unit (GCU). In the GCU, the PMG
R output is rectified into a dc control voltage.

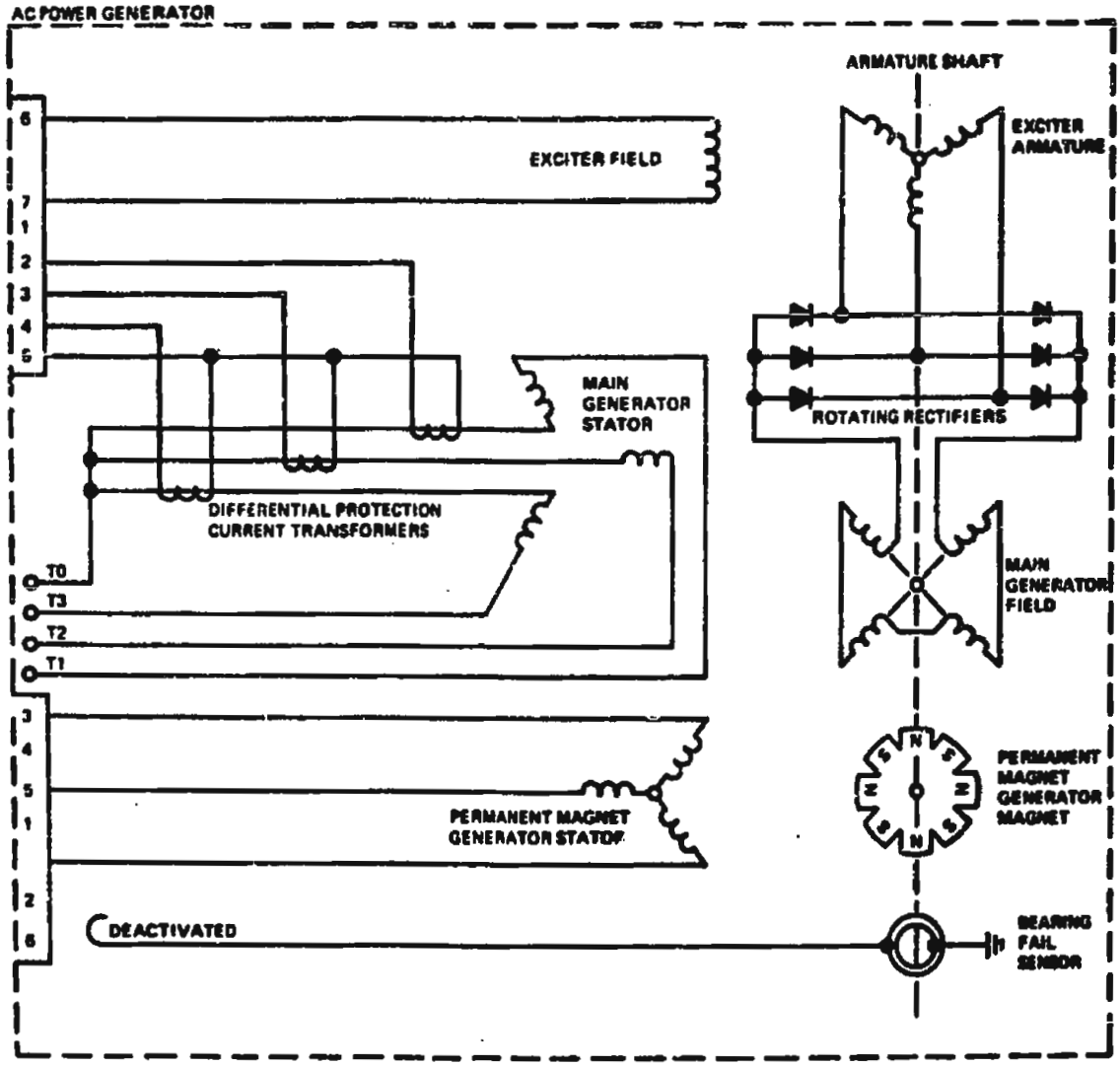
R When the generator rpm is within limits, the rectified PMG
R voltage is applied to energize the exciter field. An ac
R voltage is induced in the rotating exciter armature, which
R is full-wave-rectified by the rotating rectifiers, and
R applied to the main generator field. The rotation of the
R main field induces voltage in the main generator stator
R windings.

R The GCU senses the output of the main generator and
R regulates the field excitation voltage to maintain the
R desired output voltage. The DPCT mounted in the generator
R case are part of the feeder protection system.

R C. Automatic Operation

R With all ac power sources deenergized and power from the dc
R standby bus on the system, all generator breakers (GB) will
R be tripped and all bus tie breakers (BTB) will be closed.

R When an energized external power source is connected to the
R external power receptacle, the source output is monitored by
R the bus protection panel (BPP) for phase rotation, voltage,
R and frequency. If all values are satisfactory, the AVAIL
R portion of the EXT PWR ON/AVAIL indicator on the (FE/SO)



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CR
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AC Generator Schematic
Figure 1

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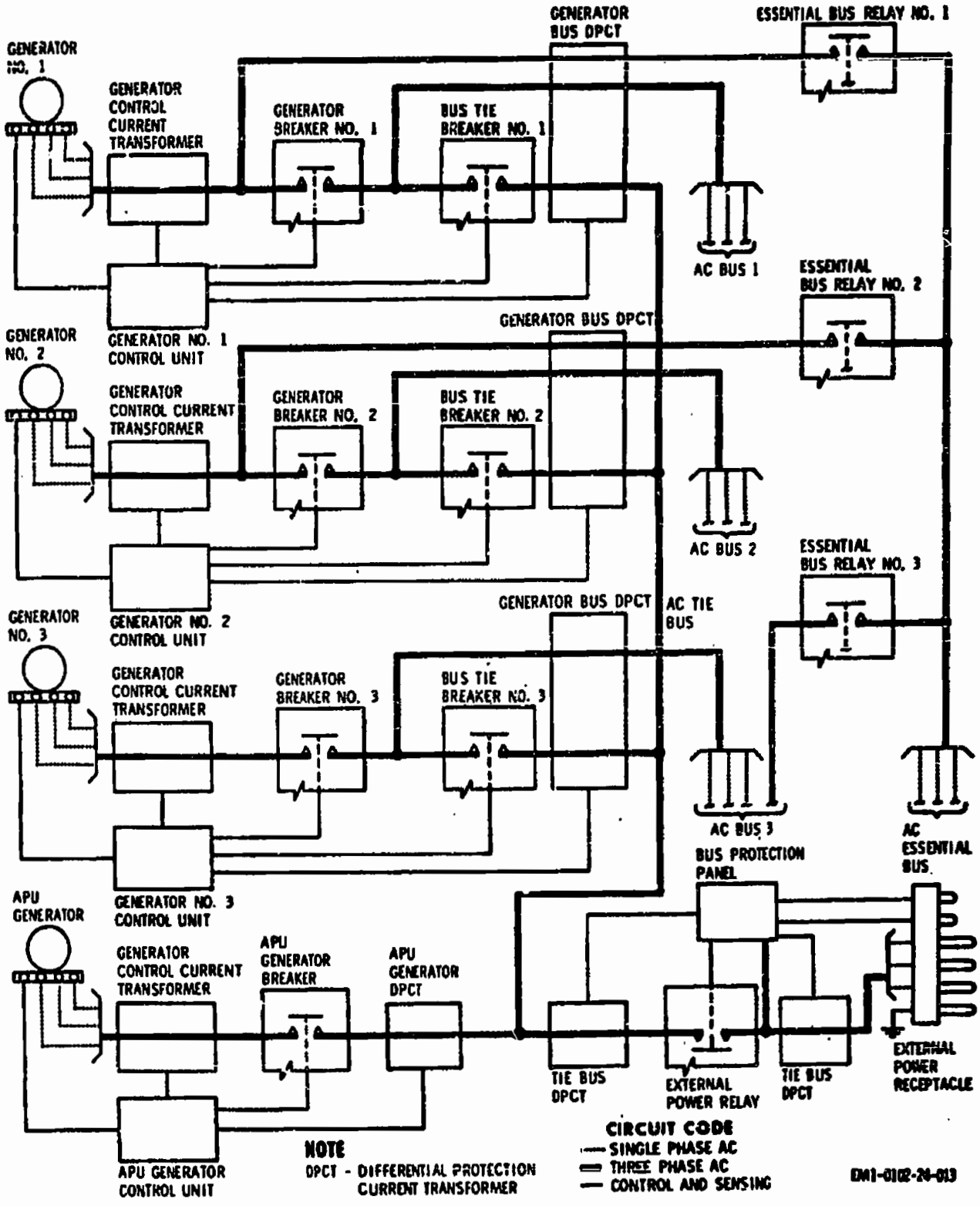


R R AC Generation System Single-Line Diagram
Figure 2

R R EFFECTIVITY: ALL

0018

ELECTRICAL control panel, zone 215, comes on (Ref. Fig. 3). When the EXT PWR switch is placed in the ON position, the external power relay actuates and connects the external source to the tie bus. Since the BTB are closed, power is applied to all buses.

If the APU is operated at the correct speed, the APU generator becomes energized. However, the APU GB cannot be closed as long as the EXT PWR switch is in the ON position. If operation from the APU generator is desired, the EXT PWR switch must be placed in the OFF position. When external power is off, the external power relay opens and the APU GB closes, which transfers the load to the APU generator.

If external power is on the buses during engine start, when the engine-driven generator comes up to frequency and voltage, the GCU opens the BTB and closes the GB, which transfers the ac bus from external power to the corresponding generator. As long as the EXT PWR switch is in the ON position, the BTB closing circuits are disabled and the generators cannot be paralleled.

When the EXT PWR switch is placed in the OFF position, a preferential circuit selects the first available generator (in the order 2, 1, 3) to energize the tie bus. After the tie bus is energized, the remaining energized generators automatically parallel by closing their BTB as soon as the correct phasing and power requirements are met. The BTB for any deenergized generator remains closed, and the corresponding bus continues to be energized by the tie bus.

When a previously unenergized generator is energized following paralleling of the remaining generators, the generator will automatically parallel by closing the GB at the proper time.

If the APU generator is placed on the buses before starting the engine generators, the APU generator becomes the master generator for automatic paralleling. The engine generators parallel with the APU generator as soon as the correct power
R and phase conditions are met.

R If the APU generator and one or more engine-driven
R generators are operating when external power is removed, an
R APU generator dead bus sensing relay, located in the mid
R electrical service center (MESC), zone 137, provides any
R operating engine-driven generators with an added priority
R over the APU generator for automatic paralleling.

D. Manual Operation

The FE/SO has several options for manual control of the generators. By depressing a GENERATOR FIELD TRIP switchlight on the FE/SO Electrical control panel (Ref. Fig. 3), he can deenergize the generator by opening the generator control relay (GCR) in the GCU. This action automatically deenergizes the generator, opens the GB, and removes the generator from the bus. If the FE/SO wants to remove an energized generator from the bus, he can press the GENERATOR BREAKER TRIP switchlight and open the GB. If he wants to isolate the bus, he must also depress the TIE BREAKER TRIP switchlight and open the BTB.

Any of these manual operations will lock out the respective breaker or relay and hold it out until the corresponding CLOSE switchlight is depressed.

R R CAUTION: MANUAL CLOSING OF THE BUS TIE BREAKER BY USING THE BUS TIE BREAKER SWITCHLIGHT WILL RESULT IN RANDOM PARALLELING. DO NOT USE THIS PROCEDURE UNLESS THE RECOMMENDED PROCEDURE BELOW IS INEFFECTIVE.

If a generator has been manually removed from the bus system, or should the automatic paralleling system fail to cause a generator to parallel into the system, the system R can be random-paralleled by manually closing the BTB. Random paralleling is not recommended; it should only be done if power will not go on the buses any other way. The R correct method of restoring a generator is as follows: R Deenergize GB (OPEN), close BTB, then close GB. The GB will R close when autoparallel conditions exist.

E. Indication System

Control switchlights and meters on the FE/SO ELECTRICAL control panel (Ref. Fig. 3) provide the following indications:

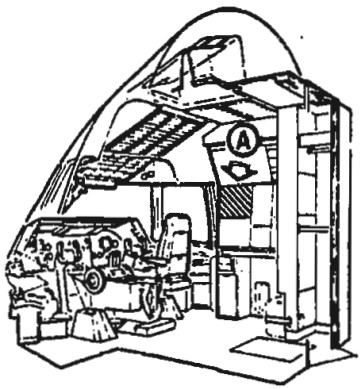
(1) GENERATOR FIELD CLOSE

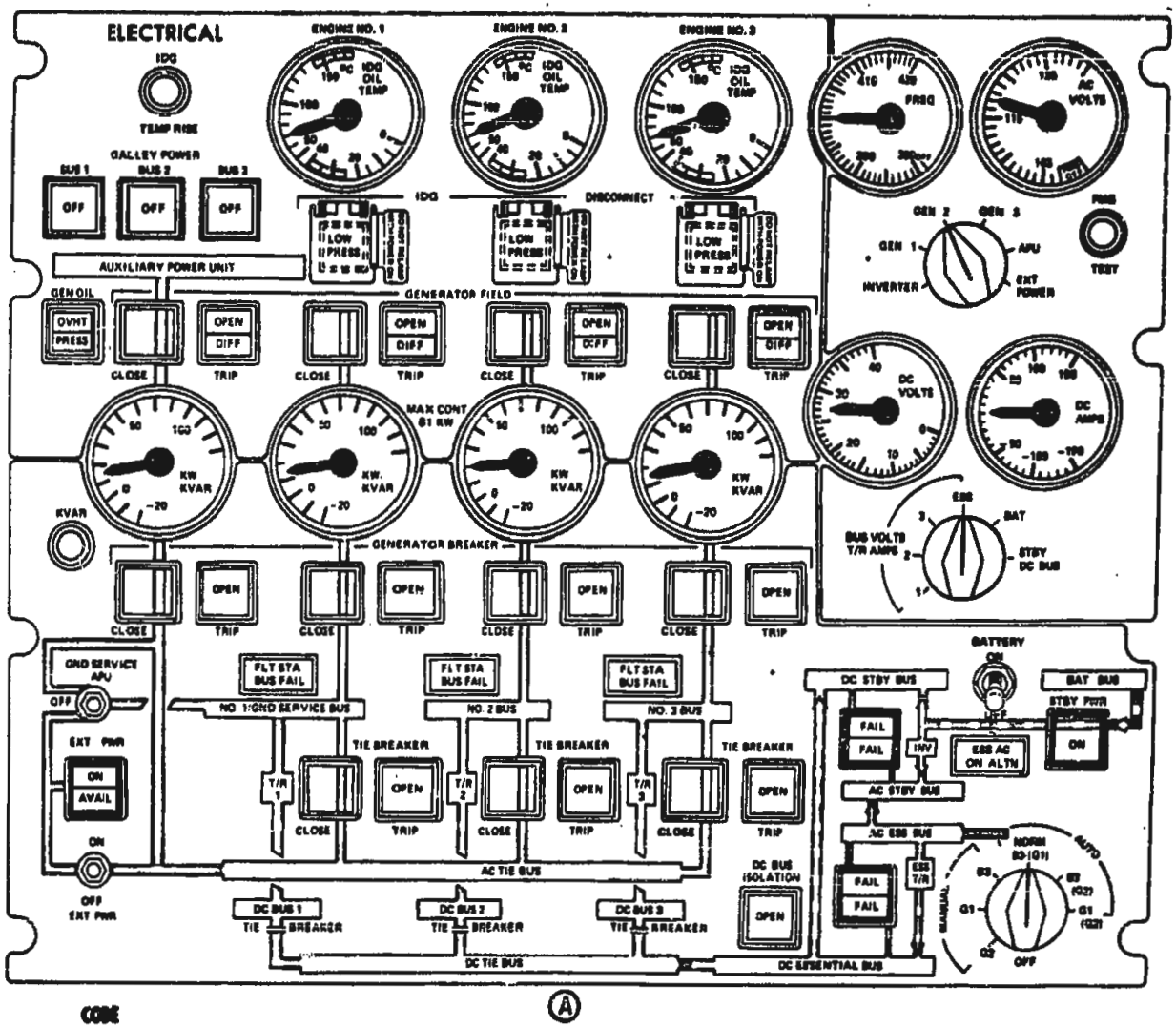
C C C (a) The BRG portion of the switchlight which indicates a generator bearing failure has been deactivated by M097766.

(b) The flowbar portion of the switchlight comes on to indicate that the GCR is closed and that the generator is ready to go on the bus (provided generator voltage is within tolerance).

(2) GENERATOR FIELD TRIP

(a) The OPEN portion of the switchlight comes on when the GCR is tripped, indicating that the generator





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R Flight Engineer/Second Officers Electrical Control Panel
R Figure 3

R EFFECTIVITY: ALL
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001B

is deenergized. At the same time, the ELECTRICAL SYSTEM annunciator light (Ref. Fig. 4) on the pilots center instrument panel, zone 210, begins to flash. Refer to 33-17-00 for description and operation of the annunciator system.

NOTE: The AUXILIARY POWER UNIT GENERATOR FIELD TRIP (OPEN) switchlight will be off whenever the APU MASTER POWER switch on the APU CONTROL panel, zone 215, is in the OFF position.

(b) The DIFF portion of the switchlight comes on if a differential protection (feeder fault) trip has occurred.

(3) GENERATOR BREAKER CLOSE

The flowbar portion of the switchlight comes on when the generator breaker is closed.

(4) GENERATOR BREAKER TRIP

The OPEN indication comes on when the generator breaker is tripped, indicating that the generator is not energizing its bus.

(5) TIE BREAKER CLOSE

The flowbar comes on when the tie breaker is closed.

(6) TIE BREAKER TRIP

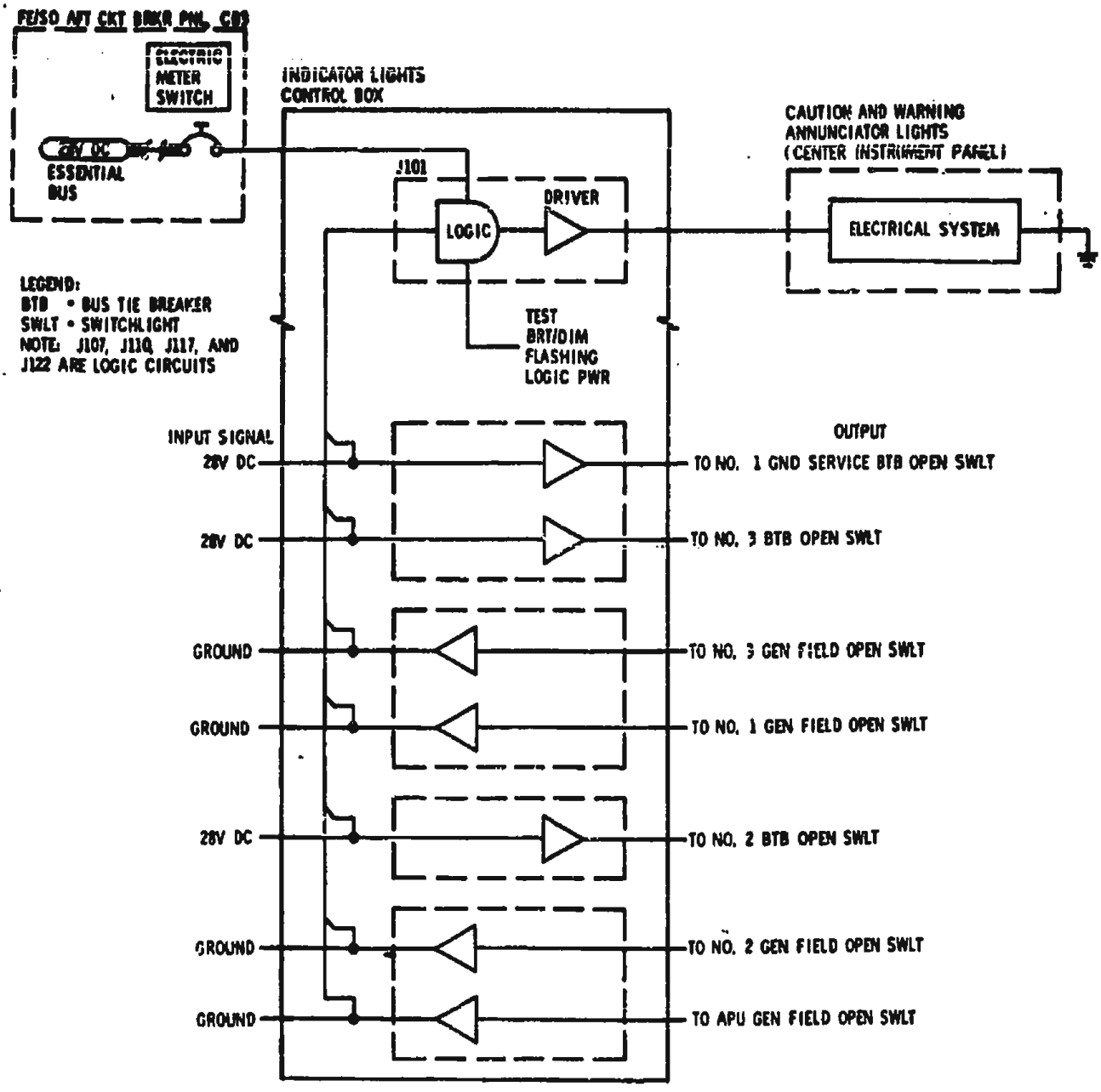
The OPEN indication comes on when the tie breaker is open. At the same time, the ELECTRICAL SYSTEM annunciator light (Ref. Fig. 4) on the pilots center instrument panel, zone 210, begins to flash. Refer to 33-17-00 for description and operation of the annunciator system.

(7) KW/KVAR Meter

(a) Description and Operation

The kW/kvar meter is a dual-purpose instrument used for reading the resistive or reactive load on the generator. A meter switching relay selects the proper connections for either mode.

The meter is contained in a standard 2-inch round instrument case. The meter face is graduated from -20 to +120.



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R Generator Field and Tie Breaker Open Fault Annunciator Lights
R Simplified Schematic
R Figure 4

The meter inputs consist of a single-phase current transformer output (B phase), and either a B-to-neutral or an A-to-C voltage. For kW operation, a meter switching relay in each system connects the B-to-neutral voltage to the meter through the normally closed contacts. For kvar operation, the relays are energized by operating a single pushbutton switch which connects the A-to-C phase voltages to the meter through a voltage dropping resistor. The meter face is illuminated by internally mounted lamps which receive power from the 0 to 5V ac panel lighting circuit.

(8) AC/PMG Voltmeter

(a) Description and Operation

The ac voltmeter is a dual-purpose instrument used for measuring ac voltages from any generator, the external power source, the inverter, or from the permanent magnet generator (PMG). The instrument is encased in a standard 2-inch round case. Electrical connections are made through a connector at the rear of the case. There are three input voltages: 115V, 400 Hz from the selected power source, rectified and reduced PMG voltage from the GCU, and 0 to 5V ac from the panel lighting circuit.

The meter face is graduated from 105 to 130 volts, with a PMG OFF segment below the 105-volt mark. A six position selector switch on the FE/SO ELECTRICAL control panel, zone 215, connects inverter output, external power B phase, or B phase of any generator to the normally closed contacts of the meter switching relay. When a generator position is selected, a PMG voltage signal from the corresponding GCU is connected to the normally open contact of the switching relay. For normal operation, the output voltage from the normally closed relay contact is applied to the meter internal circuitry, which conditions it to permit the meter to indicate the voltage. When the switching relay is energized, the PMG signal is applied to the meter. The PMG output voltage has already been processed in the GCU, and a dc output from the GCU is applied directly to the meter movement. A 2.5V dc signal causes the indicator to read 130 volts.

The 0 to 5V ac lighting input operates the internally mounted lamps.

(9) Frequency Meter

(a) Description and Operation

The frequency meter is a single-purpose instrument used to indicate the frequency of the various ac power sources. A six-position selector switch (also used for voltmeter selection) on the FE/SO Electrical control panel, zone 215, permits selection of the inverter output, external power B phase, or B phase of any generator to measure frequency.

The meter is contained in a standard 2-inch instrument case. The meter face is graduated from 380 to 420 Hz; an OFF position is marked below the 380-Hz mark.

The power output, as selected on the selector switch, is applied to the frequency meter movement. The internal meter mechanism senses the frequency and converts it to a pointer position. If the input voltage is too low to obtain an accurate frequency reading the pointer will be in the OFF position.

The meter face is illuminated by internally mounted lamps which receive power from the 0 to 5V ac panel lighting circuit.

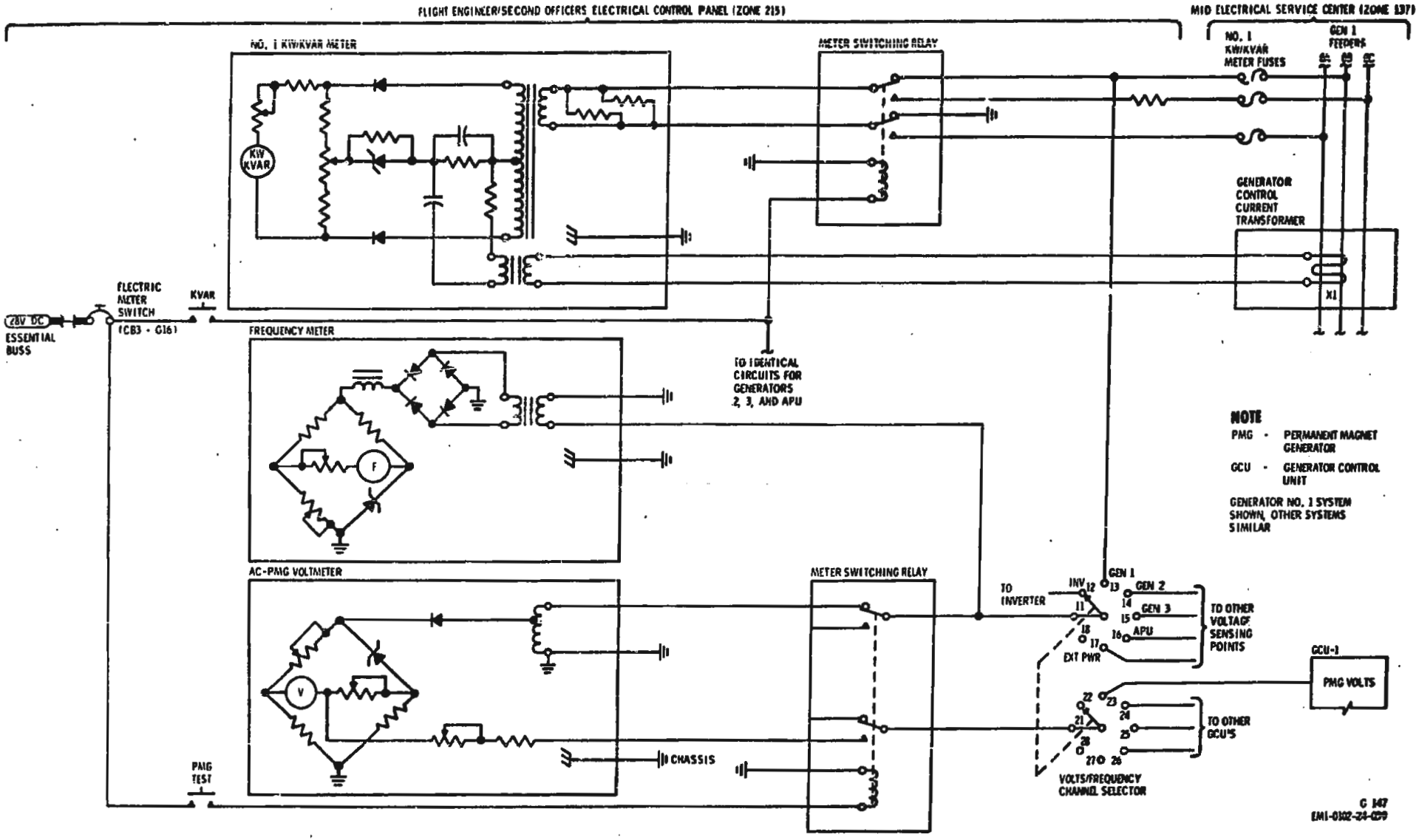
4. Generator System Failure Annunciator Panel

A. Description

The generator system failure annunciator panel (Ref. Fig. 6) consists of 28 fault indicators (annunciators) and 3 pushbutton switches mounted on a panel box containing a circuit board with 30 diodes. Connections are made to the panel by two connectors. The panel is mounted on the aft wall of the MESC with vibration isolators to dampen vibration which may cause false failure indications. The electromechanical indicators change color to indicate a failure of certain major components of the generation system.

B. Operation

Each indicator consists of a magnetic ball mounted under a transparent plastic hemisphere and backed by two electromagnets. The magnets are wound in opposite polarities. Energizing either electromagnet causes the ball



R R Generator Indication System Simplified Schematic
Figure 5

R R EFFECTIVITY: ALL

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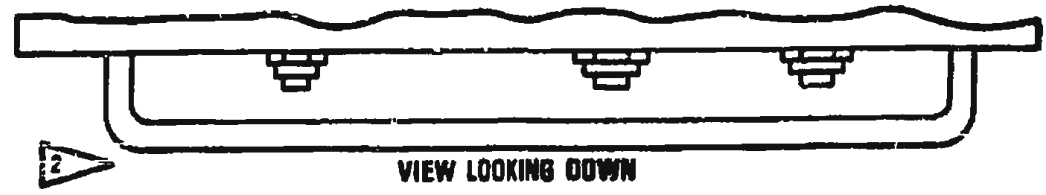

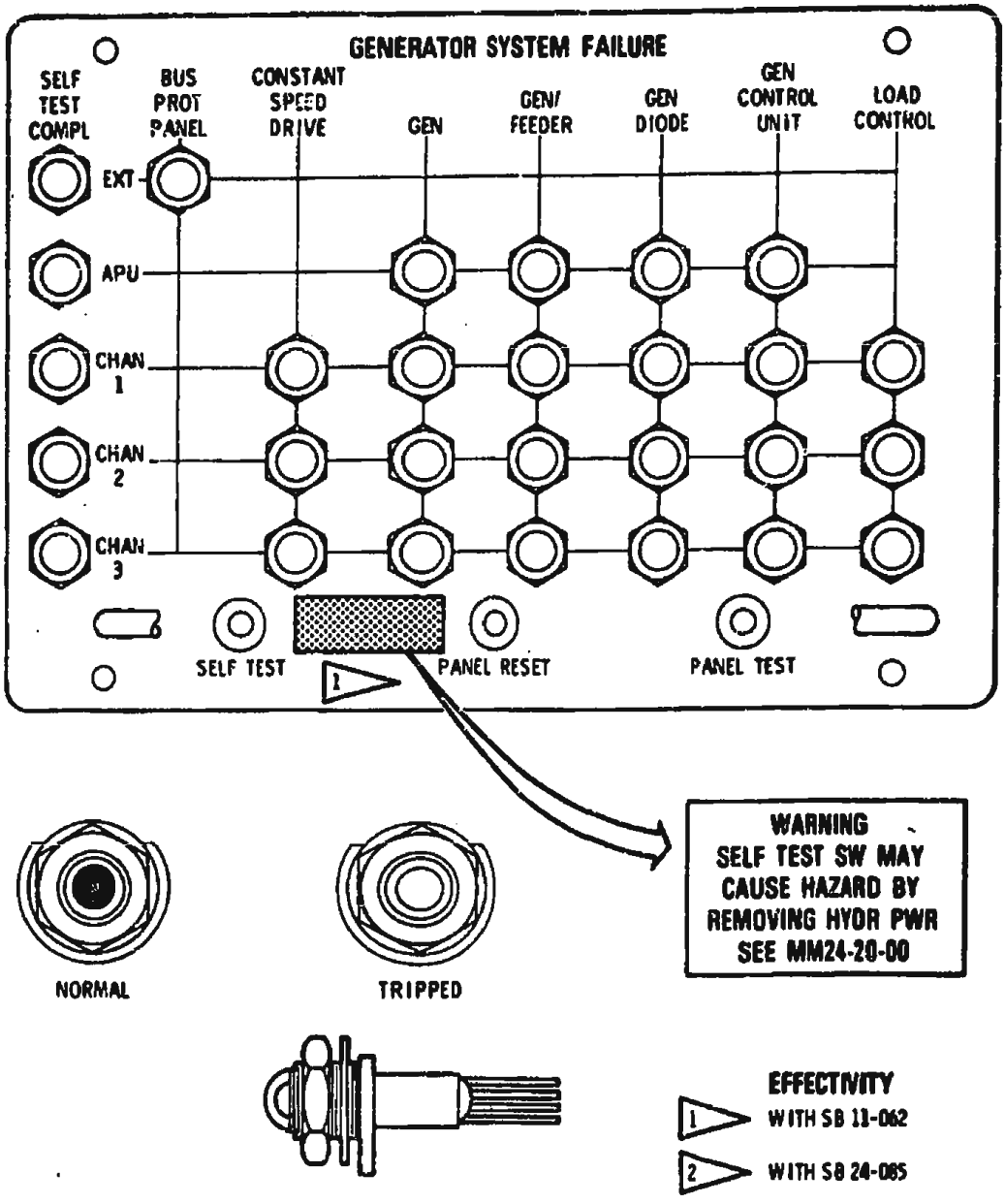

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Generator System Failure Annunciator Panel
Figure 6

to rotate to one of two positions. The magnetism in the ball holds it in the last position until the opposite coil is energized. The half of the ball showing in the normal condition is black and the other half is yellow. Thus, any indicator showing yellow indicates that a fault has been detected since the last reset. All INDICATORS on the panel are automatically reset on takeoff. This auto reset function is controlled by curcuits external to the panel which consist of an air-ground sense relay and two time delay-relays.

During normal operation of the generator system, failures of the generator, the feeders, or the GCU circuits are sensed by the GCU sensing circuits and are indicated immediately. The normally inactive (passive) circuits in the GCU have no action during normal operation.

WARNING: WHEN THE SELF TEST SWITCH IS DEPRESSED, AC POWER TO THE HYDRAULIC PUMPS IS TURNED OFF. THIS REMOVAL OF POWER DURING GROUND MAINTENANCE COULD CAUSE THE CONTROL SURFACES TO MOVE, POSSIBLY CAUSING INJURY TO GROUND PERSONNEL AND/OR DAMAGE TO THE AIRCRAFT.

The generator system failure annunciator panel indicates a GCU failure under the following conditions:

5V dc fault in the GCU

Overvoltage while the generator is unparalleled

Undervoltage while generator, IDG transmission, field current, and generator feeders are normal

Failure of a passive sensing circuit to pass the self-test mode

The GCU circuits cause the GEN/FEEDER indicator to come on in the event of an open phase, or a zone 1 or 2 differential fault protection trip (Ref. Fig. 13). Other GCU circuits enter into the detection of IDG transmission and generator failures.

CAUTION: WHEN THE SELF TEST SWITCH IS PRESSED, THE GENERATOR OVERLOAD RELAY ENERGIZES FOR A CHECK OF THE LOAD-SHEDDING CIRCUITS. IF THE GALLEY POWER CIRCUITS AND/OR THE AC HYDRAULIC PUMP CIRCUITS ARE ENERGIZED, THESE CIRCUITS WILL DEENERGIZE AND LOCK OUT UNTIL THEIR RESPECTIVE CONTROL SWITCHES ARE PLACED IN THE OFF POSITION.

The passive sensing circuits can be manually tested after system shutdown. Power from the 28V dc ground service extension bus (Ref. Fig. 7) is applied to the (BPP), the generator system failure annunciator panel, and to auxiliary contacts of each (GB). As each generator is shut down, the associated GB trips, which closes the auxiliary contacts and applies power to the GCU and the generator system failure annunciator panel. When the SELF TEST pushbutton switch on the failure annunciator panel is pressed momentarily, a signal is sent to the BPP and the GCU. This signal activates the self-test circuits and artificially excites the passive sensing circuits. If any circuit fails to respond properly, a trip signal is sent to the corresponding unit indicator. A time-delay circuit in the GCU permits the test to continue for 8 to 13 seconds and then shuts off the test circuit. During the test cycle, inhibiting circuits prevent the protective circuit outputs from causing the normal trip reactions, which leaves the system in the normal functional condition following the test.

If the GALLEY POWER switchlights on the FE/SO Electrical control panel, zone 215, are in the on position (latched in) when the SELF-TEST pushbutton switch is pressed, the following events will occur: The OFF indication in each switchlight will come on, and galley power will fail and remain locked out until the three switchlights are released. When the three switchlights are released (out), the OFF lights go off, and the lockout is disabled. This constitutes a functional check of the generator overload relay. Galley power is restored by pressing the GALLEY POWER switchlights (latched in).

On aircraft 001-031, with SB24-085 and 032-999

a guard is installed over all three switches on the annunciator panel to prevent their being inadvertently pressed.

When the test cycles for the BPP and the GCU have been completed, the SELF TEST COMPL indicators on the panel change to indicate that the test cycle has been completed. If the indicators fail to operate, the test circuits in the associated system are malfunctioning.

Pressing the PANEL TEST pushbutton switch trips all indicators to verify their operational condition. The PANEL RESET pushbutton switch resets all tripped indicators.

5. Generator Control Unit (GCU)

A. Description

A GCU provides control and protection functions for each generator. Each GCU is contained in a case. The case has an extractor/holddown handle on the front and a plug-in connector at the rear. Figure 8 shows a cutaway view of the GCU.

The GCU circuitry is solid state except for four relays and two circuit breakers. More than 60 percent of the control and protective circuits are integrated circuits. Eleven printed circuit boards are used to mount the majority of the components. Units such as the field relay, large power resistors, power transistors, and stud-type rectifiers are mounted on the chassis structure.

As far as practical, the circuit boards are designed to a modular concept with each functional circuit on one board. The individual boards plug into connectors mounted on the main chassis. The connectors are keyed to prevent circuit boards from being installed incorrectly. The boards and connectors are also numbered for identification.

All circuit boards are coated with a clear 100-percent silicone resin for protection against moisture and corrosion. The relays are hermetically sealed, and all transformers are potted for environmental protection.

The GCU cover is removable for access to the printed circuit boards and the adjustment points. Normally, all adjustments are made in a shop test rig.

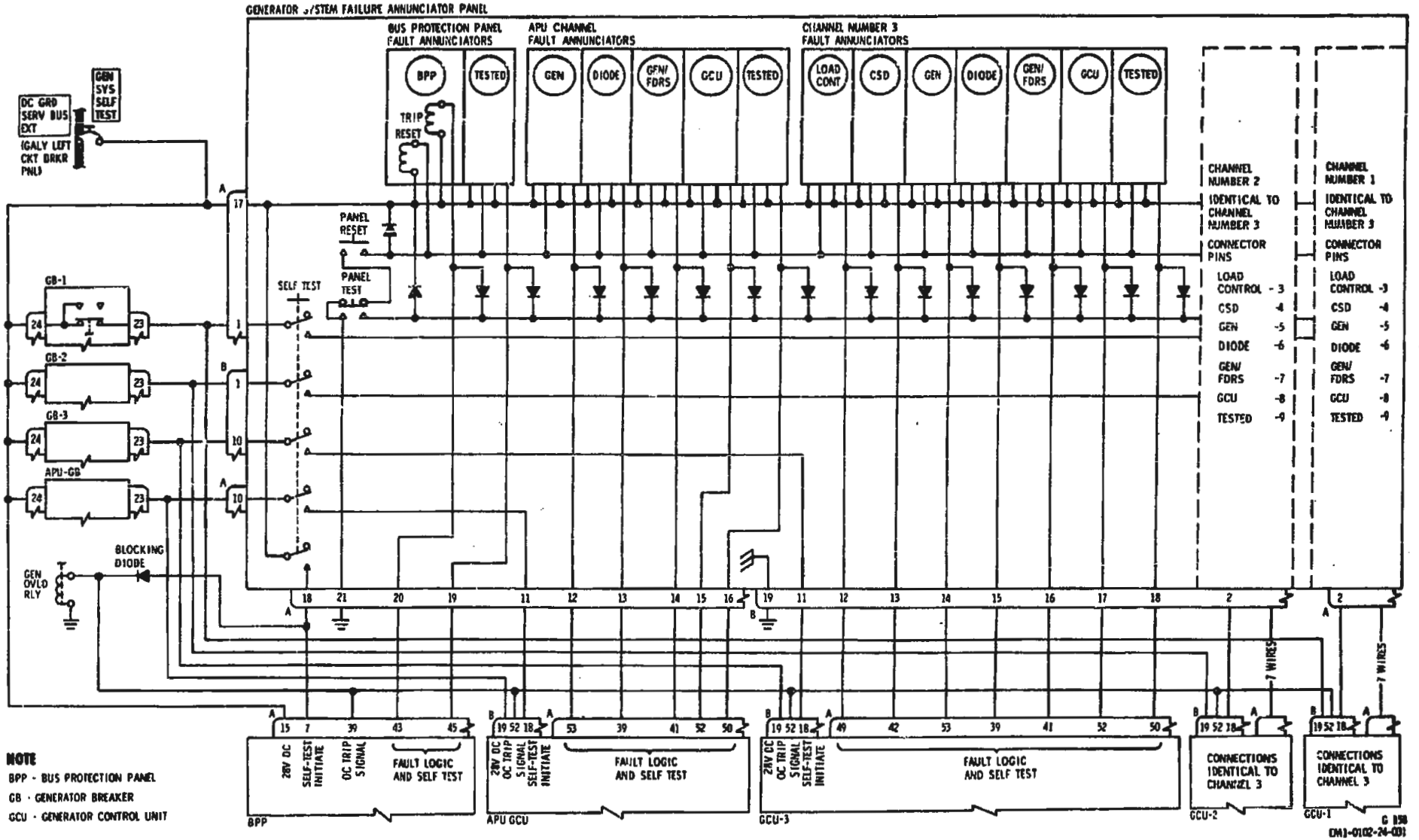
The GCU are installed in racks in the MESC (side compartments), zones 138 and 137. The convection-cooled GCU require no special cooling system.

B. Operation

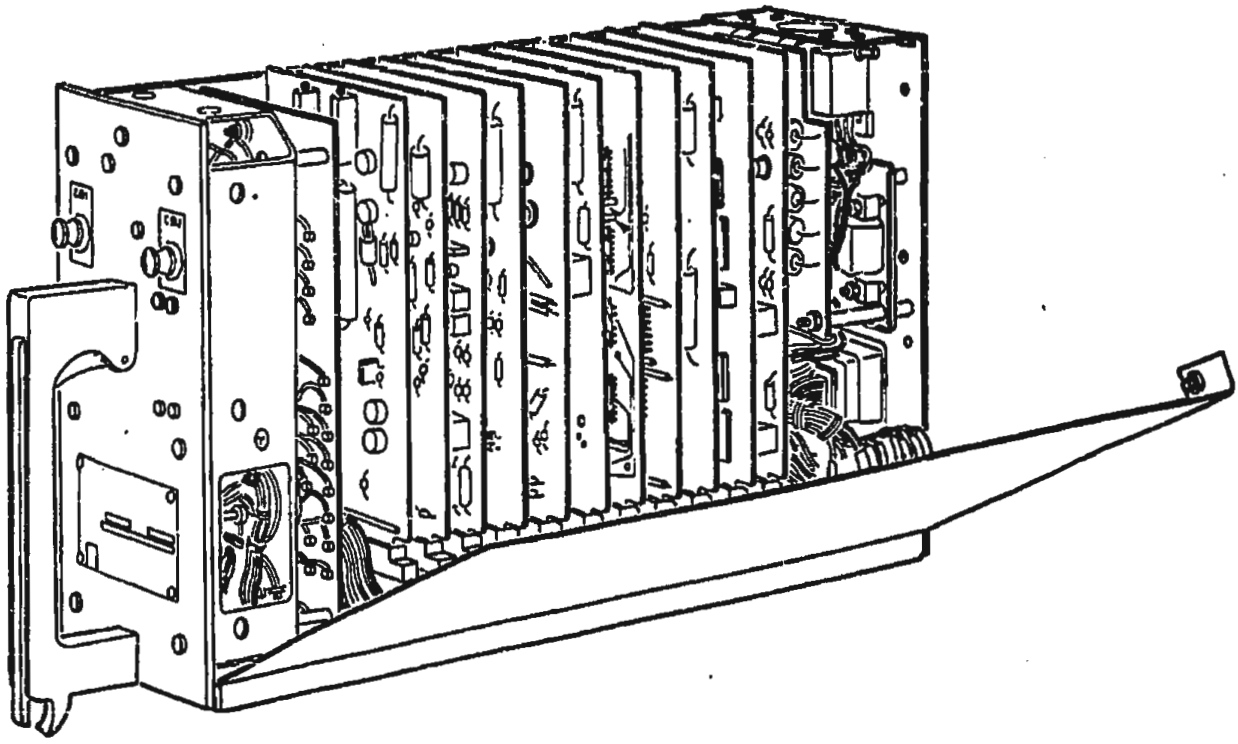
The circuitry of the GCU divides into several functional sections. The sections, which often interface during operation, are described individually.

(1) Voltage Regulation

The voltage regulator uses a pulse-width-modulated transistor control of the exciter field current to maintain a constant generator output voltage. The voltage regulator is three phase average sensing with high phase take-over capability during unbalanced fault or load condition. The generator voltage is sensed at the ac distribution panel in the MESC. This is the point of regulation. This sensed signal is applied to a summing point where it combines with the reactive load division signal. The output from this summing



R Generator System Failure Annunciator Panel Simplified Schematic
R Figure 7



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Generator Control Unit
Figure 8

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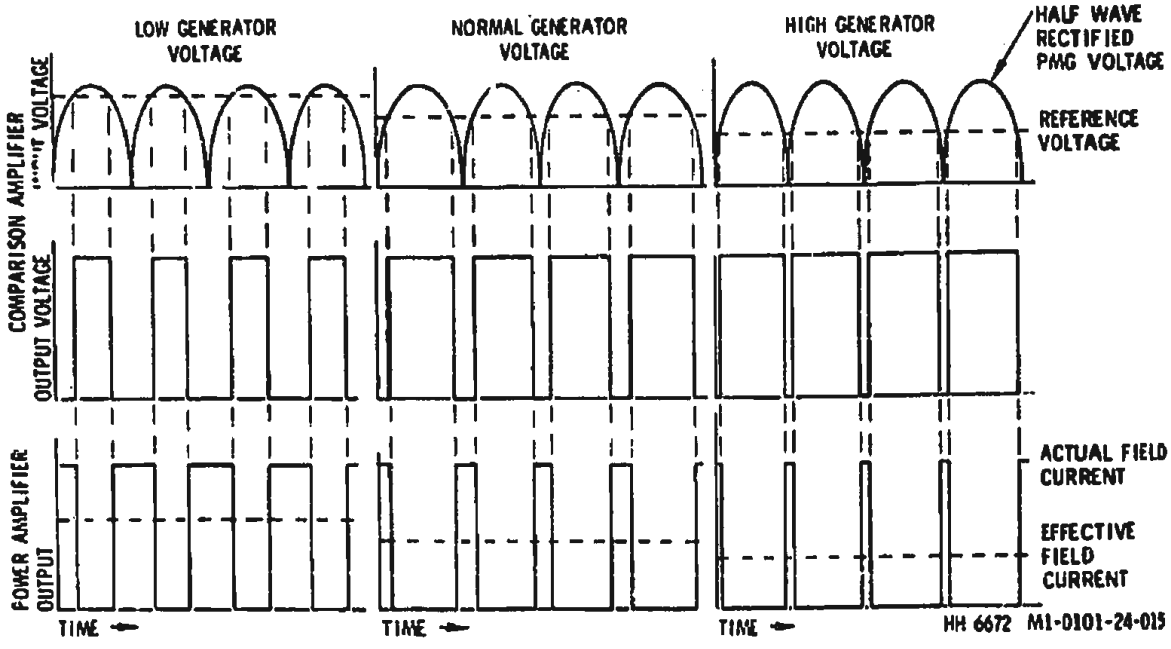
point is next applied to a dynamic compensation network whose output is then compared with a load current limiting signal. The resulting output is integrated with an attenuated full wave rectified PMG ripple and feedback signal. The integrated output is applied to a pulse-width modulated switching amplifier, then to a power amplifier, and finally to the generator exciter field. Figure 9 shows the relation of field current to sensing circuit output.

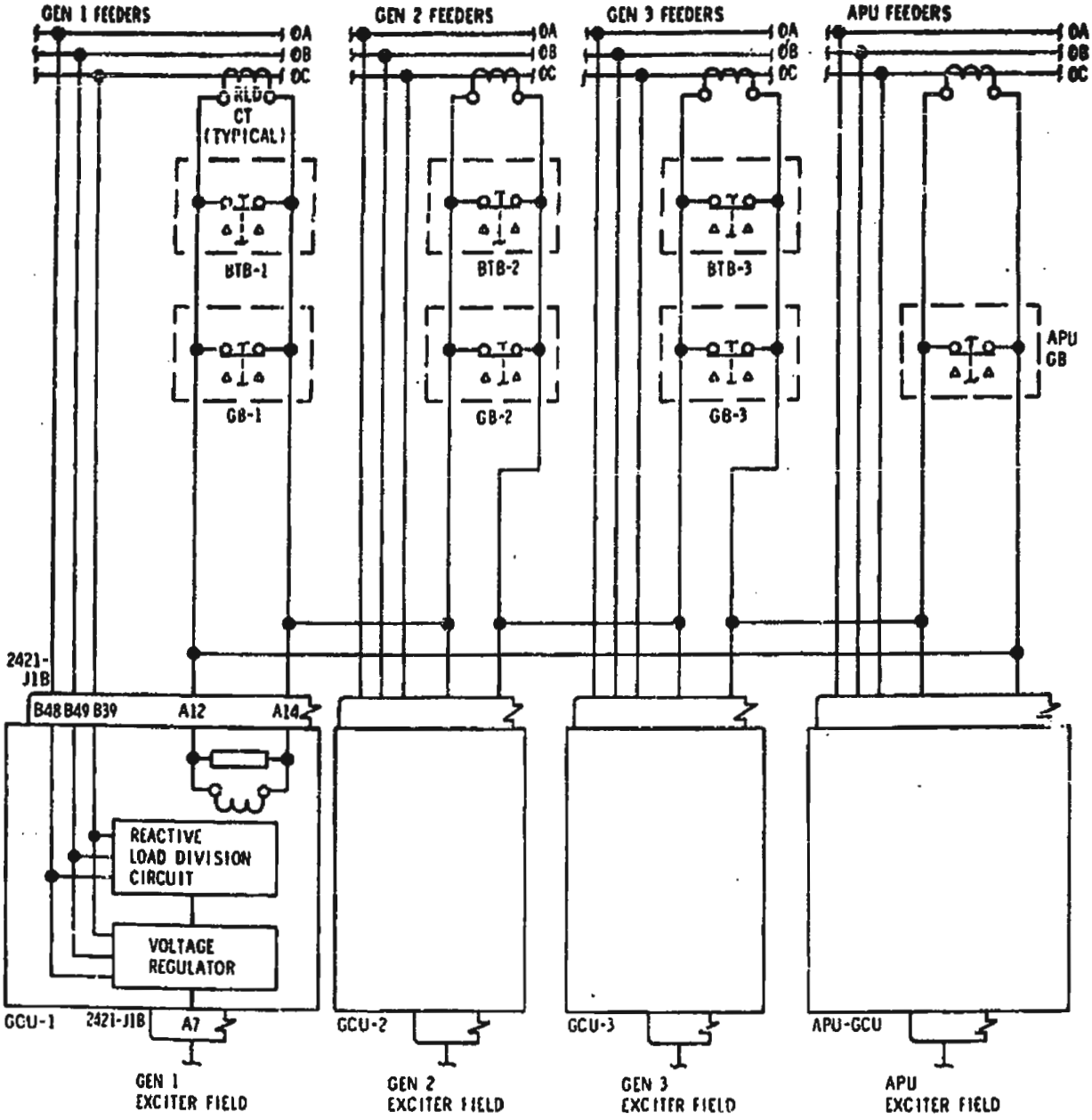
Stabilizing circuits are provided to prevent excessive transient voltages during generator buildup and sudden load-change conditions.

(2) Reactive Load Division

The reactive load on each generator is sensed by a GCU circuit receiving voltage inputs from Phases A and B, and a current input from the reactive load division current transformer winding of the GCCT assembly. The current transformers on each generator sense the current in Phase C. The transformers are connected in a loop configuration so the signal developed across each sensing circuit is proportional to the difference of that generator current from the average of the other paralleled generators (Ref. Fig. 10).



Voltage Regulator Sensing Output vs Field Current
Figure 9



NOTE

BTB-BUS TIE BREAKER
GB -GENERATOR BREAKER
GCU-GENERATOR CONTROL UNIT
RLD-REACTIVE LOAD DIVISION
CT -CURRENT TRANSFORMER

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Reactive Load Division Sensing Loop Block Diagram
Figure 10

The output of the reactive load division circuit is applied to the voltage regulator as a bias to increase the excitation of the generator(s) carrying too little load, and to decrease the excitation of the load-hogging generator.

The generator breaker (GB) and bus tie breaker (BTB) contacts short out the current transformers so that an inoperative or nonparalleled generator will not affect the operation of the other generators.

(3) Current Limiting

A current-limiting circuit is provided to limit the maximum energy output of the generator. The output is limited to approximately 550 amperes per phase. Windings in the GCCT package sense the current in all three phases. The transformer outputs are rectified and summed to form a signal voltage proportioned to the current. This voltage is compared to a reference voltage. If the current, and therefore the signal voltage, rises above a predetermined level, the comparison circuit applies an output as a bias to the voltage regulator to reduce the exciter field excitation.

(4) Generator Field Control and Indication

The generator exciter field circuit is controlled by contacts of the generator control relay (GCR). The GCR is controlled by the generator control relay control circuit. When the GCR is tripped, the contacts open the field circuit and remove excitation from the generator.

The GCR automatically trips (after a time delay of 0.6 to 1.0 second) whenever an underspeed condition is sensed by the speed monitoring circuit. With an underspeed trip, the GCR automatically resets when the generator again comes up to speed.

The GCR also automatically trips when an overvoltage, undervoltage, an open phase, or a zone 1 differential fault (Ref. Fig. 12) is sensed. When tripped by any of these conditions, the GCR must be manually reset by the GENERATOR FIELD CLOSE switchlight on the FE/SO ELECTRICAL control panel, zone 215.

Manual tripping of the GCR can be accomplished by pressing the GENERATOR FIELD TRIP switchlight on the electrical control panel. Pulling the fire emergency engine shutoff control for the driving engine also

trips the GCR. Both of these trips must be reset manually.

An anticycling lockout system prevents repeated trip-reset action when the CLOSE switchlight is held during attempts to reset an automatic trip with the cause still present. If an automatic trip condition is present, the GCR will reset and retrip only once for one depression of the CLOSE switchlight.

(5) Generator Breaker Control

Close and trip signals to the GB are provided by circuits in the GCU. Silicon controlled rectifiers are used to provide nominal 28V dc signals to the breaker coils. A close signal will appear when the GCR is closed and no trip signal is present (undervoltage, underspeed, or GCR trip) no lockout exists from a manual trip, or from a differential protection zone 2 trip, and one of the following conditions exists:

(a) The GENERATOR BREAKER CLOSE switchlight is closed (this also cancels the manual trip lockout)

(b) The BTB is tripped

(c) An autoparallel or a dead generator bus signal is present

The GB trips either automatically when the GCR trips, or manually by operating the GENERATOR BREAKER TRIP switchlight. Manual trip operation applies a lockout to the automatic reset circuits. The lockout is removed by operating the GENERATOR BREAKER CLOSE switchlight.

(6) Bus Tie Breaker Control

The BTB control is similar to the GB control. Silicon controlled rectifiers are used to provide the voltages to trip and close the breaker.

Two different groups of system faults act to trip the BTB. An overexcitation, an underexcitation, an undervoltage, or a difference current fault will trip the BTB, but will not inhibit the automatic reclose circuit. A zone 2 differential fault (Ref. Fig. 12), or a signal from the TIE BREAKER TRIP switchlight will trip the breaker and inhibit the auto reclose circuit. After these trips (with the exception of a zone 2 differential fault), the BTB can be reset by operating the TIE BREAKER CLOSE switchlight. After a zone 2

differential fault, the BTB can only be reset by removing all DC and PMG power.

When one of the first group of faults causes a BTB trip, which is immediately followed by a GB trip, the BTB automatically recloses within 25 milliseconds to keep the load bus energized from the tie bus. The BTB will automatically close only if there is an autoparallel or preferential signal present.

(7) Essential Power Relay Control

The essential bus power system provides for automatic transfer of power sources for the ac essential bus. A signal is supplied by the GCU to indicate when each generator is available as a power source. The signal is available when the GCR is closed, and when the voltage and frequency are satisfactory.

(8) Autoparalleling Control

The autoparalleling system senses the voltages on the generator side of the GB and on the tie bus. The voltages are compared for equality, phase relationship, and frequency. When the frequency difference is less than 6 Hz and the phase angle difference is less than 90 degrees, the sensing circuit closes the applicable GB or BTB to parallel the generator with the tie bus, provided all other protective circuits will permit. Inhibit circuits prevent autoparalleling if the EXT PWR switch on the electrical control panel is in the ON position.

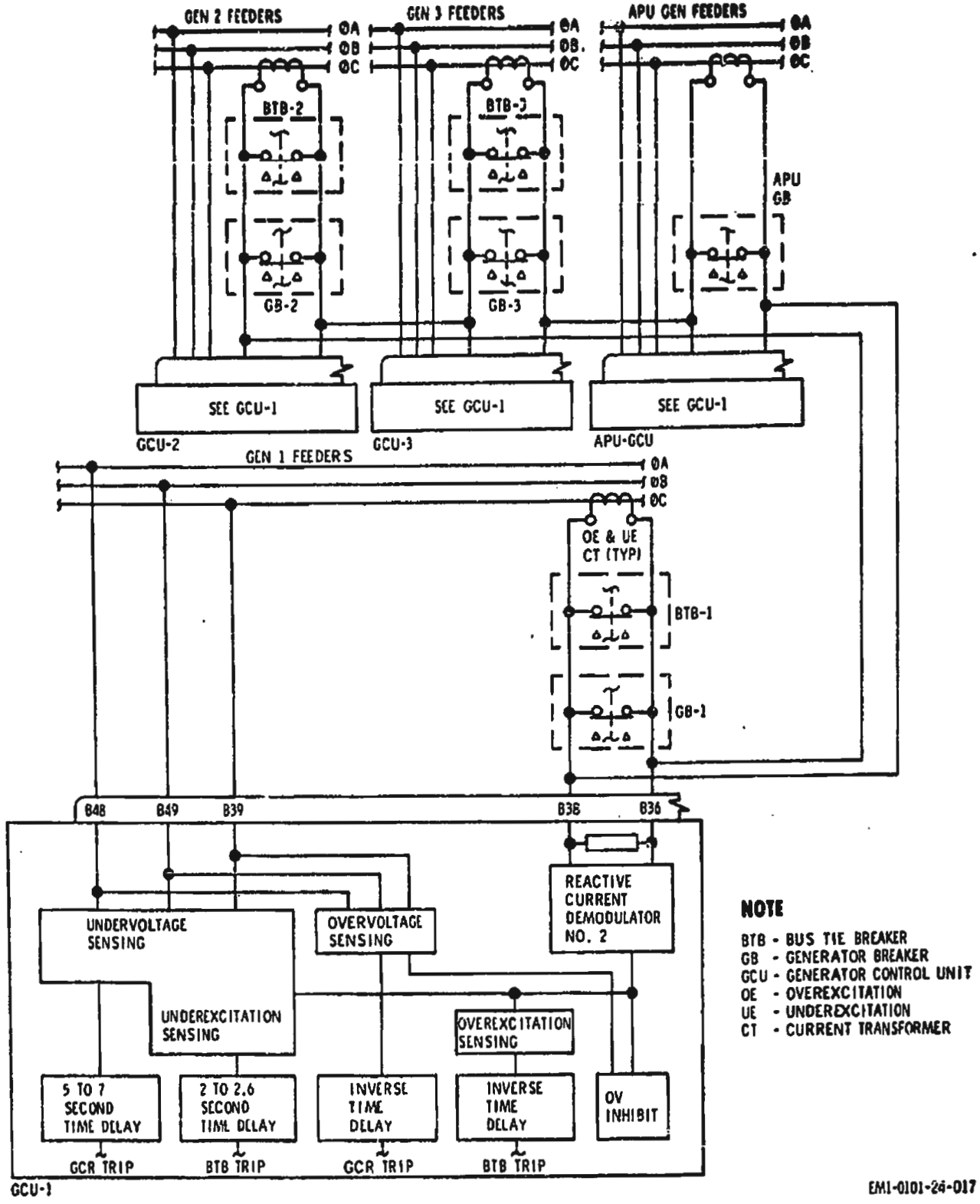
(9) Dead Generator Bus Sensing

The dead generator bus circuit bypasses the autoparalleling circuit if the voltage on the load bus is less than 25 volts. If this condition exists, the GCU signals the GB to close, provided all other logic will permit.

(10) Overvoltage and Overexcitation Protection

Overvoltage sensing is done by three single-phase stepdown transformers (Ref. Fig. 11) connected to the generator output leads.

The transformer outputs are half wave rectified, paralleled, and filtered to provide an average sensing of the three-phase output. The sensing circuit output is connected to a voltage divider circuit which is



NOTE

BTB - BUS TIE BREAKER
GB - GENERATOR BREAKER
GCU - GENERATOR CONTROL UNIT
OE - OVEREXCITATION
UE - UNDEREXCITATION
CT - CURRENT TRANSFORMER

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Voltage and Exitation Deviation Protection Block Diagram
Figure 11

adjusted to establish the minimum overvoltage trip level at 130 (±3) volts, line-to-neutral.

A reactive load sensing circuit compares the reactive load on the generator with the average reactive load on all the paralleled generators. The reactive load sensing circuit biases the voltage divider circuit to lower the trip point on an overexcited generator (carrying excessive reactive load) and raise the trip point on an underexcited generator.

The output of the voltage divider circuit is connected to an inverse time-delay circuit, which will trip at a maximum time of 5 seconds at 134 volts. With an inverse delay, the higher the voltage the shorter the time until trip occurs.

If the overvoltage is combined with excessive overexcitation (sensed by the reactive load sensing circuit), a time-delay inhibit signal prevents operation of the inverse time-delay circuit. However, a second inverse time delay is activated and opens the BTB. Opening the BTB eliminates the reactive load sensing and removes the inverse time-delay inhibit. If the overvoltage still exists, the inverse time delay trips the GCR and GB. After the GB trip, the automatic BTB reclose circuit recloses the BTB and reenergizes the load bus.

(11) Undervoltage and Underexcitation Protection

The same circuit (Ref. Fig. 11) which controls the overvoltage protection also provides undervoltage and underexcitation protection. Undervoltage is sensed by the same transformer/filter circuit that senses the overvoltage. The sensing circuit output is applied to a second voltage divider which controls both the pickup and dropout points. Upon startup, the undervoltage system closes the GB at 100 (±3) volts increasing voltage. In the event of an undervoltage condition, the system trips the GCR at 100 (±3) volts decreasing voltage. During parallel operation (of three or more generators), the reactive load sensing circuit biases the voltage divider circuit to provide selective operation in the event of underexcitation faults.

An underspeed signal is supplied to inhibit the undervoltage circuit when the generator is operating below normal speed.

If an undervoltage condition occurs, time-delay circuit number 2 (TD-2) is energized if the generator is not

under speed and the GB is closed. After 2 to 2.5 seconds, the time-delay output trips the BTB.

At the same time, time-delay circuit number 1 (TD-1) is energized. If the undervoltage condition continues after the BTB trips, TD-1 trips the GCR and GB within 5 to 7 seconds.

(12) Underspeed Protection

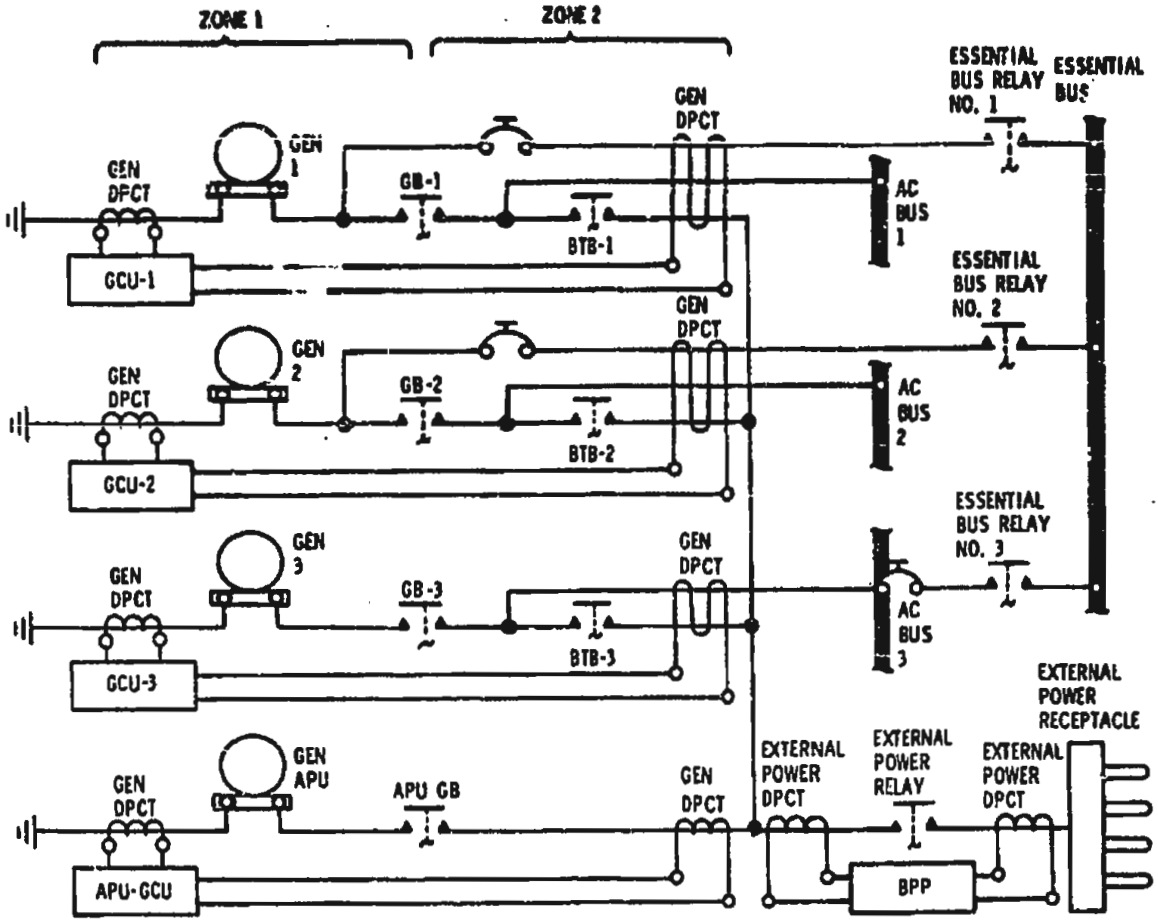
On aircraft 001-020 without SB24-023, the sensing of underspeed is a function of an overrunning clutch in the IDG transmission. If a paralleled generator loses its driving power, the generator motors and continues to run at rated speed, causing the clutch to overrun. A speed-sensing switch controlled by the IDG transmission governor is installed on the transmission case. The switch opens when the transmission output rpm is above minimum rated speed and closes if the speed drops below that point. To maintain uniformity of the systems, a speed-sensing system in the APU control supplies similar signals to the APU-GCU. The signal from the underspeed switch is applied to a time-delay circuit which trips the GCR and GB if an underspeed condition lasts for more than 1 second. The underspeed signal also locks out any undervoltage or underexcitation signals, which prevents false trips during underspeed conditions. When the frequency returns to normal, the underspeed system automatically resets the generator and returns it to the bus.

On aircraft 001-020 with SB24-023, and 021-999, a generator shutdown relay, located in the MESC, zone 137, for each motor driven generator prevents the generator from energizing before engine rpm (N3) reaches 51 percent. Placement of the FUEL & IGNITION switch to the OFF position sends an underspeed signal to the GCU which trips the generator off the line (Ref. Fig. 18).

(13) Differential Fault Protection (DPCT)

The DPCT at the generator neutral leads and at the tie bus side of the BTB are connected to isolation transformers in the GCU (Ref. Fig. 12 and 13).

If a short occurs in the sensing leads, the transformers isolate the short from the sensing loops in the GCU. The transformers connected to the generator neutral DPCT have two secondary windings each. One set of secondaries are used in the



NOTE

BPP - BUS PROTECTION PANEL

BTB - BUS TIE BREAKER

DPCT - DIFFERENTIAL PROTECTION CURRENT TRANSFORMER

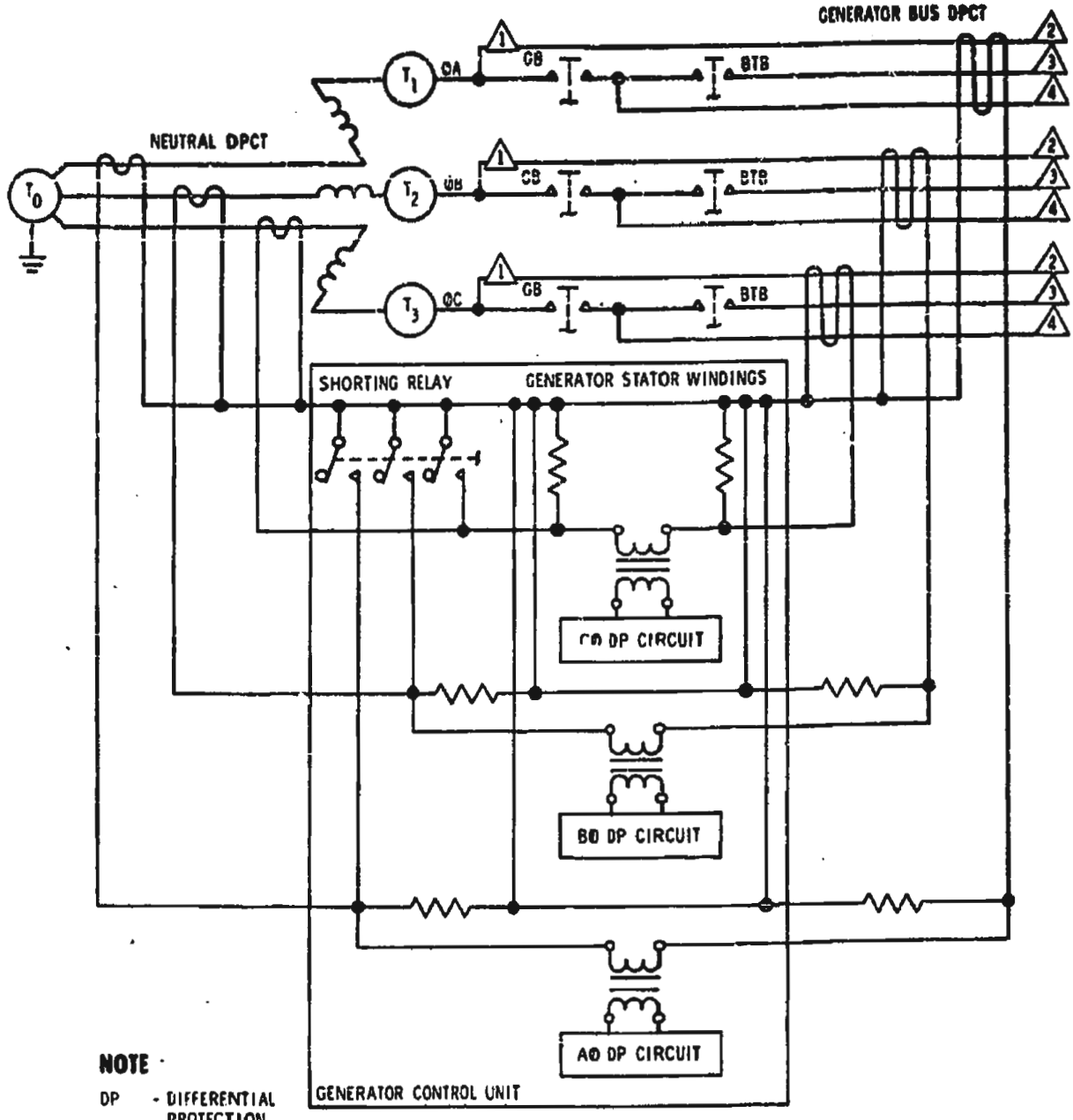
GB - GENERATOR BREAKER

GCU - GENERATOR CONTROL UNIT

SHOWN AS SINGLE PHASE SYSTEM FOR SIMPLICITY

EM1-0102-24-018

Differential Fault Protection Block Diagram
Figure 12



NOTE

DP - DIFFERENTIAL PROTECTION

DPCT - DIFFERENTIAL PROTECTION CURRENT TRANSFORMER

ESS - ESSENTIAL

GB - GENERATOR BREAKER

BTB - BUS TIE BREAKER

1. ON NO. 3 GENERATOR SYSTEM ONLY, THIS WIRE CONNECTS TO AC BUS 3
2. TO AC ESSENTIAL BUS
3. TO AC TIE BUS
4. TO CORRESPONDING AC BUS 1, 2, OR 3

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Single Channel Differential Fault Protection
Functional Diagram
Figure 13

open-phase protection circuit. The other set of secondaries are connected in a differential configuration to the secondaries of the corresponding generator bus DPCT isolation transformers. As long as the current sensed by the generator neutral DPCT is equal to that sensed by the generator bus DPCT, the secondary outputs will cancel and no signal will be applied to the sensing circuit.

If the current in the neutral DPCT becomes 50 (±10) amperes greater than the bus current, the sensing circuit trips the GCR and the GB after a maximum time-delay of 0.04 second and energizes two time delay circuits. If the fault is on the generator side of the GB (zone 1), the fault current will disappear and the generator will be isolated. A second relay in the GCU is also energized during a differential trip. The relay shorts out the outputs of the neutral DPCT to prevent the energy stored in the generator from indicating a false zone 2 fault condition. The stored energy would continue to feed a zone 1 fault for a fraction of a second after the GCR trips, and would continue indicating the fault if the DPCT were not shorted.

If the fault is on the load side of the GB and the BTB, the fault will still be fed through the BTB and will be sensed by the generator bus DPCT. The continued signal keeps the two time-delay circuits energized. After a total time of 0.1 second, the first time delay trips the BTB associated with that load bus. Opening of the BTB clears the fault. However, if the BTB fails to open, the second time-delay circuit signals all other BTB and the APU GB to trip and remove all power from the fault and from the tie bus. The trip occurs within 0.11 to 0.15 second from the first indication of a fault.

Protection for faults on the tie bus side of the BTB is provided by the undervoltage trip of all BTB and the APU GB.

(14) Open Phase Protection

The open phase protection circuit trips the GCR if the current on any phase drops below 6 (±5) amperes while the current of any other phase is over 25 amperes. The sensing portion of the circuit uses the second set of secondaries on the generator neutral DPCT isolaltion transformers. The transformer outputs are rectified and connected to two circuits which sense the amount of current in each phase. One circuit signals if any one

phase is above 25 amperes, and the other circuit signals if any phase is below 6 (±5) amperes. If both signals occur at the same time, a 5- to 7-second time-delay circuit is energized. If the open phase condition continues, the time delay trips the GCR and the GB.

(15) *Difference Current Protection*

The difference current protection circuit senses load division errors caused by drive or control malfunctions, and backs up the overexcitation and underexcitation protection circuits. Current transformers on the Phase A lead of each generator are connected in series so that load sensing circuits that are in parallel with each current transformer measure the difference between the individual generator current and the average of the other paralleled generators (Ref. Fig. 14).

The input from the sensing loop is passed through an isolation transformer, full wave rectified, and applied to a voltage divider circuit. The voltage divider is adjusted to set the trip point between 49 to 61 amperes. The voltage divider output is connected to an inverse time-delay circuit which times out in approximately 8 seconds with an 80-ampere overcurrent. The output of the time-delay circuit trips the associated BTB.

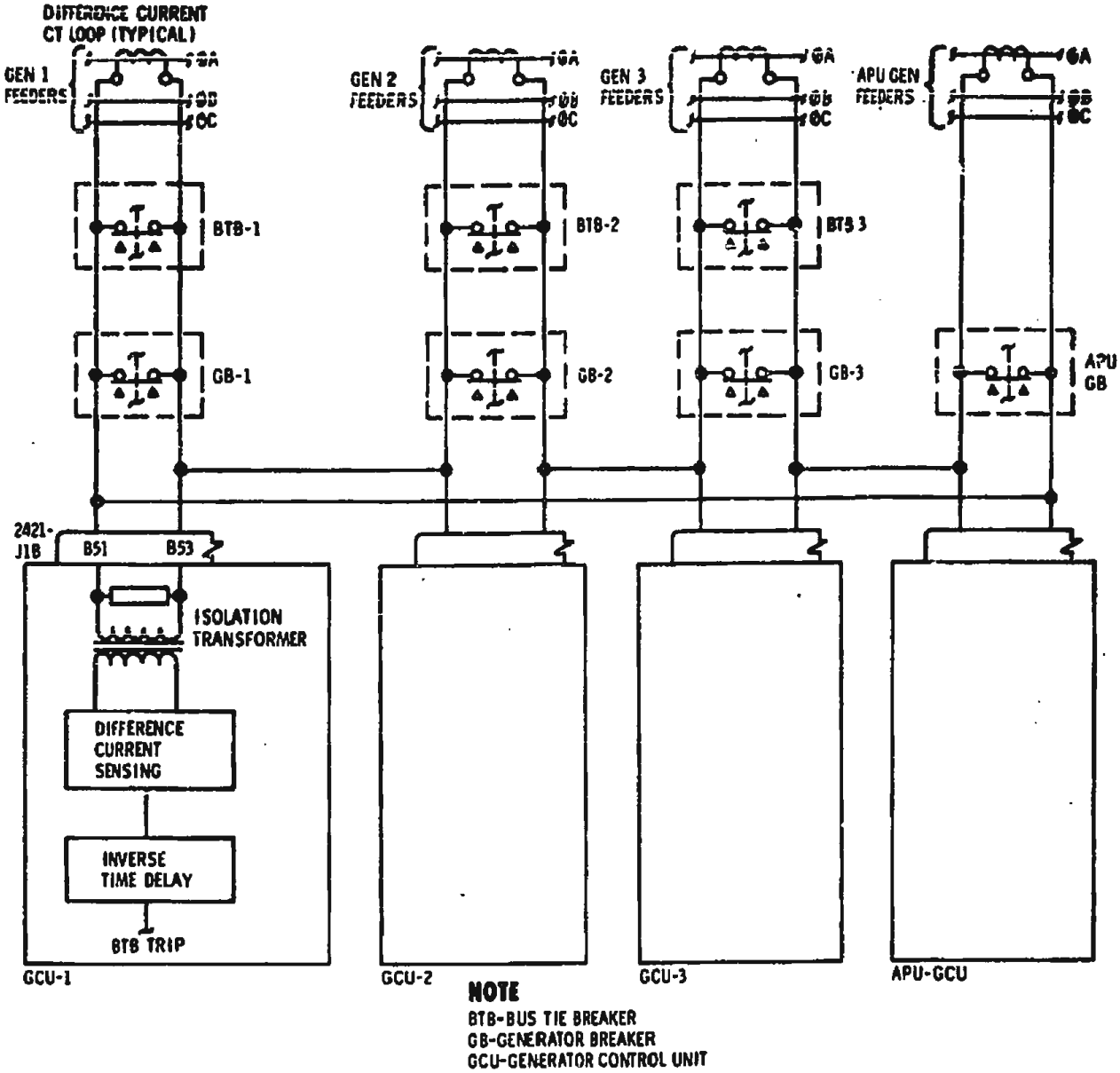
(16) Overcurrent Protection

The overcurrent protection uses one of the current limiting current transformers for sensing. The current transformer output is passed through an isolation transformer, rectified, and applied to a voltage divider circuit which sets the trip level limits between 335 to 375 amperes. The voltage divider output is applied to a fixed (1.5 to 2.0 seconds) time-delay relay. The time-delay output is a 21 to 30V dc signal which is sent to the automatic load monitoring circuit to remove nonessential loads from the bus.

NOTE: On aircraft with service bulletin 24-063 the GCU overcurrent protection trip level limits will be between 280 to 320 amperes.

(17) DC Control Power

Normal control power for the GCU is rectified from the PMG output. A second power source is provided by the aircraft dc system. All control and protective



NOTE

BTB-BUS TIE BREAKER
GB-GENERATOR BREAKER
GCU-GENERATOR CONTROL UNIT

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R Difference Current Protection Block Diagram
R Figure 14

functions operate with either or both of the power sources energized. Either source has enough capacity to operate the GB and BTB while supplying control power to the other functions.

In addition to the unregulated 28V dc power, the GCU circuits develop precision 16 and 5V dc for reference voltage and operation of the micrologic circuits.

A protective zener diode circuit is provided to prevent transient overvoltages generated by the using equipment from damaging the semiconductor circuits. The limiting circuit limits low-frequency transients to a maximum of 80 volts.

(18) Generator Control Unit Outputs

Unregulated 28V dc outputs are provided to operate the GB, the BTB, the emergency shutoff system, and the essential power relay. The voltage/current characteristics of this power are as required for the operation of the relays and breakers. The power will not decay to less than 15 volts during any system fault condition.

6. Generator Control Current Transformer (GCCT)

A. Description and Operation

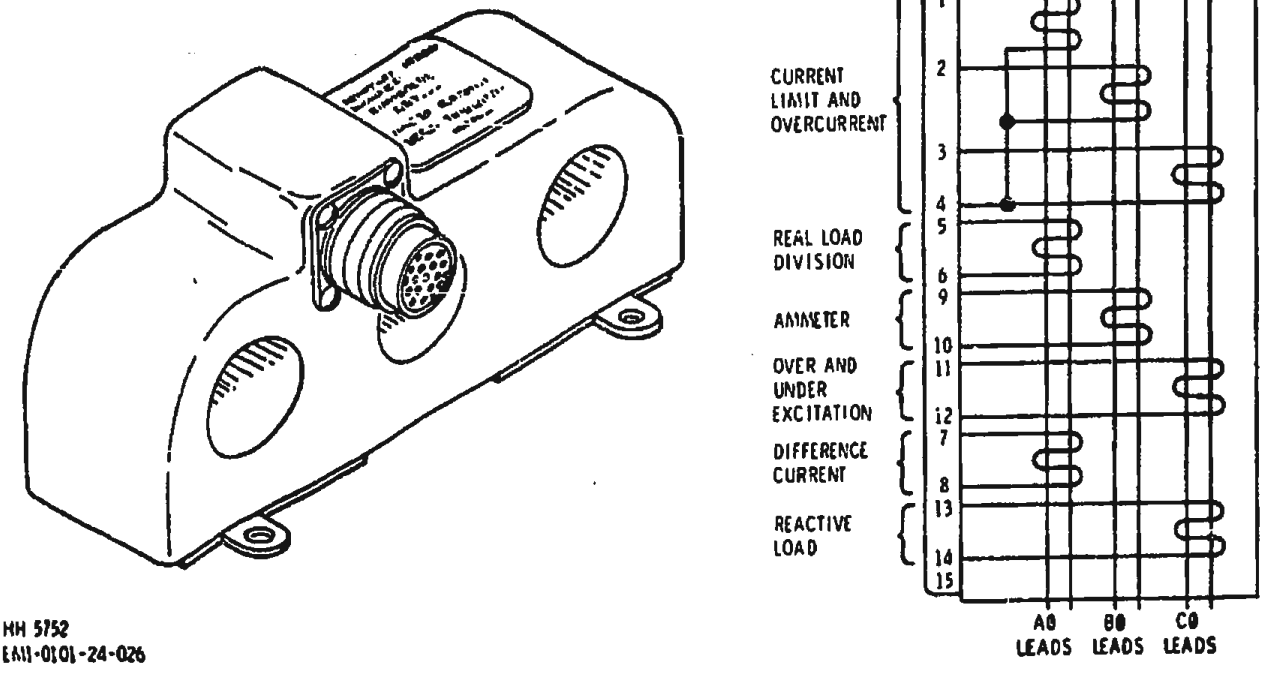
The GCCT assembly consists of eight toroidally wound current transformers mounted in a molded plastic case and potted with light-weight epoxy casting compound. The connections to the transformers are made through a socket pin connector mounted on the top of the unit. Four asymmetrically spaced mounting holes in the base ensure that the unit cannot be mounted in the wrong polarity. Figure 15 shows the assembly and a schematic of the wiring. Four assemblies, one for each generator, are located in the MESC, zone 137.

The GCCT assembly provides signals to the GCU for current limitation and overcurrent sensing (three-phase), over/underexcitation sensing (C phase), difference current sensing (A phase), and reactive load division signals (C phase). The unit also supplies a signal to the real load controller (A phase) and to the ac ammeter circuit (B phase).

7. Generator and Bus Tie Breaker

A. Description and Operation

Identical three-phase power breakers are used for both the GB and the ac bus tie breakers. The breaker (Ref. Fig. 16) consists of heavy duty three-phase, single-throw, double-break, main contacts and 16 sets of single-pole, double-throw, auxiliary contacts. The contacts which are controlled by two coils, are magnetically latched in either the tripped or closed position. Two sets of the auxiliary contacts are used to remove power from the coils following actuation. The other auxiliary contacts are connected as single-pole, single-throw (six sets), or single-pole, double-throw (seven sets) switches through a connector for external use. Table 1 lists the characteristics of the breaker.



HH 5752
EAII-0101-24-026

Generator Control Current Transformer
Figure 15

R Breaker Characteristics
R Table 1

ITEM		CHARACTERISTIC
	MAIN CONTACTS (6)	
Configuration		Normally open, three-pole, single-throw, double-break, magnetically latched
Voltage		115/200V, 400 Hz, 0.75 pf
Current ratings		
Rated		265 amp
Overload		350 amp for 15 seconds, 500 amp for 7 seconds
Interruption		3,500 amp
	AUXILIARY CONTACTS (11 SETS)	
Configuration		Six sets SPST, five sets SPDT
Voltage		15V dc
Current ratings		
Resistive		0.100 amp
	AUXILIARY CONTACTS (2 SETS)	
Configuration		SPDT
Voltage		115V ac/28V dc
Current ratings		
Resistive		2 amp/7.5 amp
Reactive		- - -/5 amp
Lamp		- - -/1 amp
	COILS	
Duty cycle		Intermittent (deenergized by internal switches)

R Breaker Characteristics (Cont)
R Table 1

ITEM	CHARACTERISTIC
Operating voltage	15V minimum, 32V maximum
	GENERAL
Operating times	
Closing	50 ms at 15V, 25 ms at 26.5V
Tripping	15 ms at 15V
Electrical life	50,000 cycles minimum
Mechanical life	100,000 cycles minimum
Weight	4.5 pounds maximum

R 8. Differential Protection Current Transformer (DPCT)

R A. Description and Operation

R The DPCT assembly consists of three toroidally wound current transformers mounted in a molded plastic case and potted with lightweight epoxy compound. The connections to the transformers are made through a socket pin connector mounted on the side of the unit. Four asymmetrically spaced mounting holes in the base ensure that the unit cannot be installed in the wrong polarity. Figure 17 shows the unit and a schematic of the wiring. Six units are used in the system. Five are mounted in the MESC, zone 137, and one is mounted next to the external power receptacle under the forward cargo compartment floor, zone 124.

R Four of the DPCT assemblies are matched to the integrally mounted transformers on the generator neutral leads. The sets of transformers provide three-phase sensing of faults in the generator feeders. Two of the units are interconnected to provide fault sensing on the external power feeders

R 9. Bus Protection Panel (BPP)

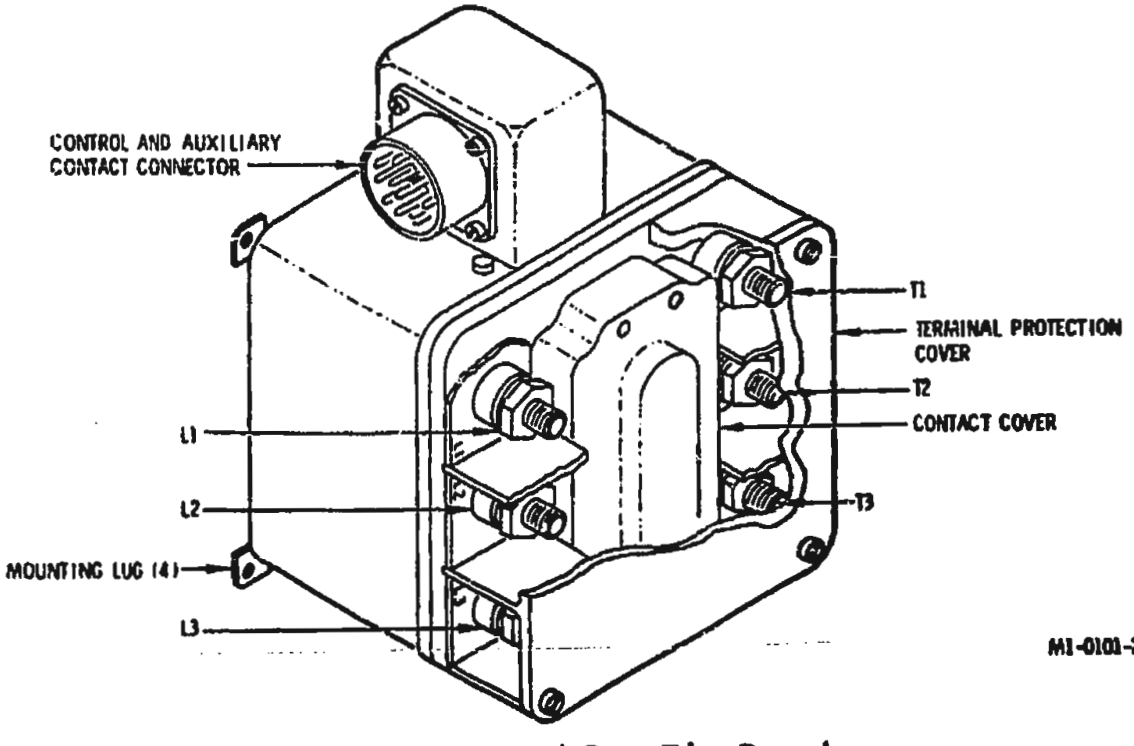
R A. Description

The BPP protects the aircraft buses from receiving unsuitable power from a faulty external power source. The BPP also provides the power to control the interlocking of the tie bus system. The panel (Ref. Fig. 19) is contained in a case which is mounted on a standard rack in the MESC left side compartment, zone 137. An extractor/holddown handle on the front of the case and a dual unit connector on the rear of the case permit rapid removal and replacement of the unit. The majority of the circuits in the panel are solid-state and integrated circuit components mounted on six plug-in module boards. Whenever possible, all components in a functional circuit are mounted on one board. Those components which are not suitable for board mounting, such as power transistors and the power supply transformer-rectifier, are mounted on the main chassis. The convection-cooled panel requires no special cooling system.

B. Operation

(1) Control

When an energized external power source (Ref. Fig. 20) is connected to the aircraft, the BPP senses all three phases and checks for correct voltage, frequency, and phase rotation. If all conditions are satisfactory, the BPP supplies control power to the EXT PWR switch



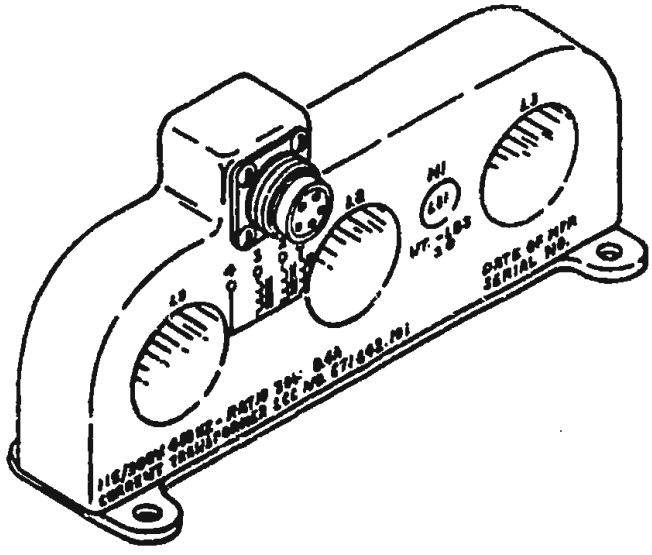
R Generator and Bus Tie Breaker
R Figure 16

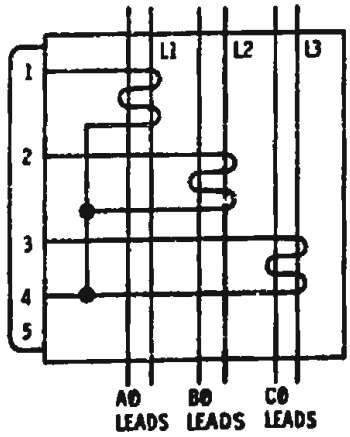
and to the EXT PWR ON/AVAIL indicator (AVAIL portion) on the FE/SO Electrical control panel, zone 215. If the EXT PWR switch is placed in the ON position, the control power is returned to the BPP where it energizes an external power relay (EPR) control circuit. Power from this circuit energizes the EPR and signals all GCU that the external power is on. This signal prevents the GCU from closing the GB without first opening the BTB, thus keeping any generator from being paralleled with external power.

A similar circuit (Ref. 24-41-00, Fig. 3) provides control of the ground service relay and the EPR through the ground service control switches.

A dead tie bus circuit senses an absence of ac voltage on the tie bus. With no tie bus voltage, 28V dc is available from the dc ground service bus extension. With the EXT PWR switch in the OFF position, the BPP energizes the preferential circuit to close the BTB of the highest priority available generator to energize the tie bus. The priority order is 2, 1, 3, with the first available generator energizing the tie bus, and the others paralleling when conditions permit.

(2) External Power Feeder Protection





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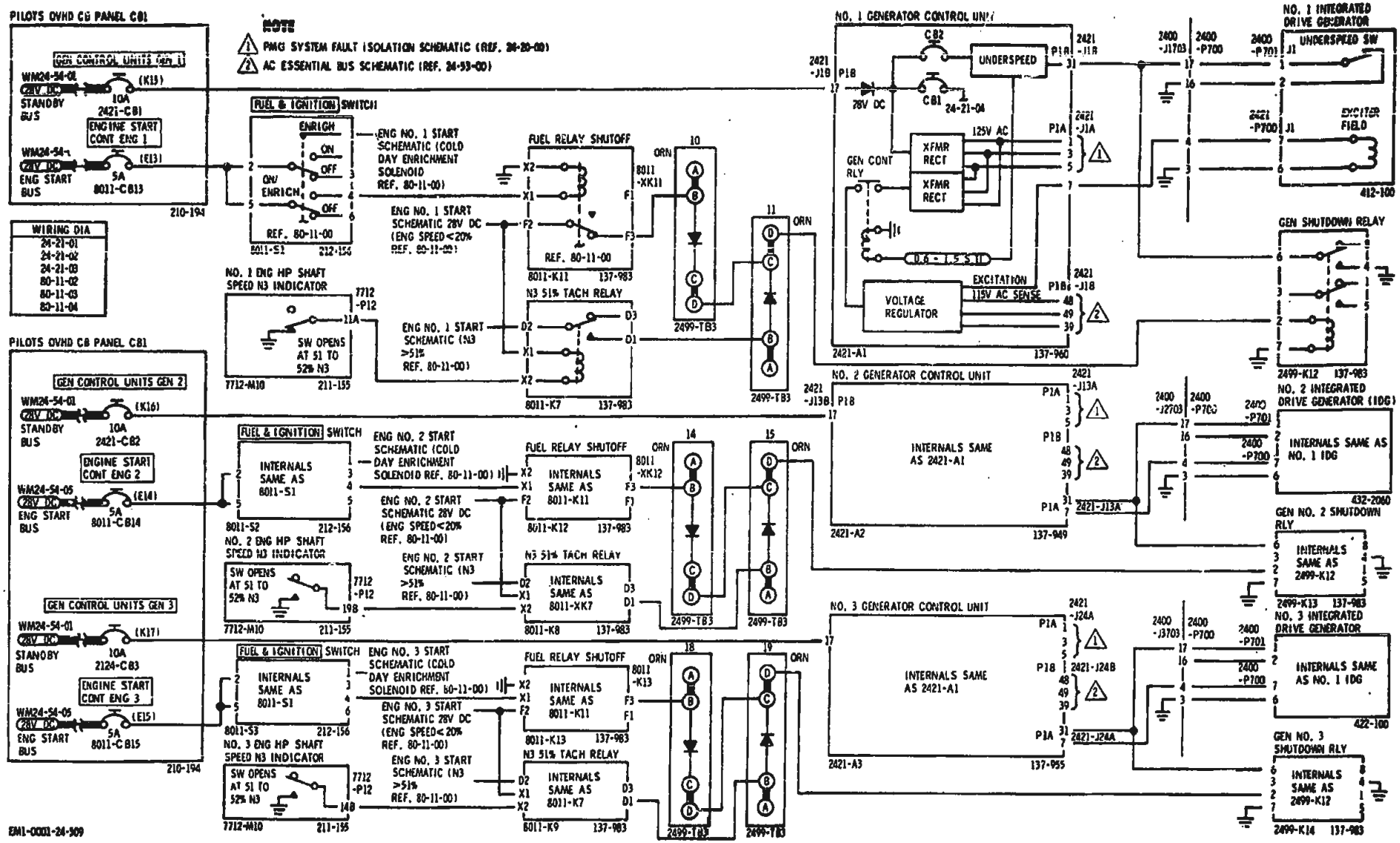
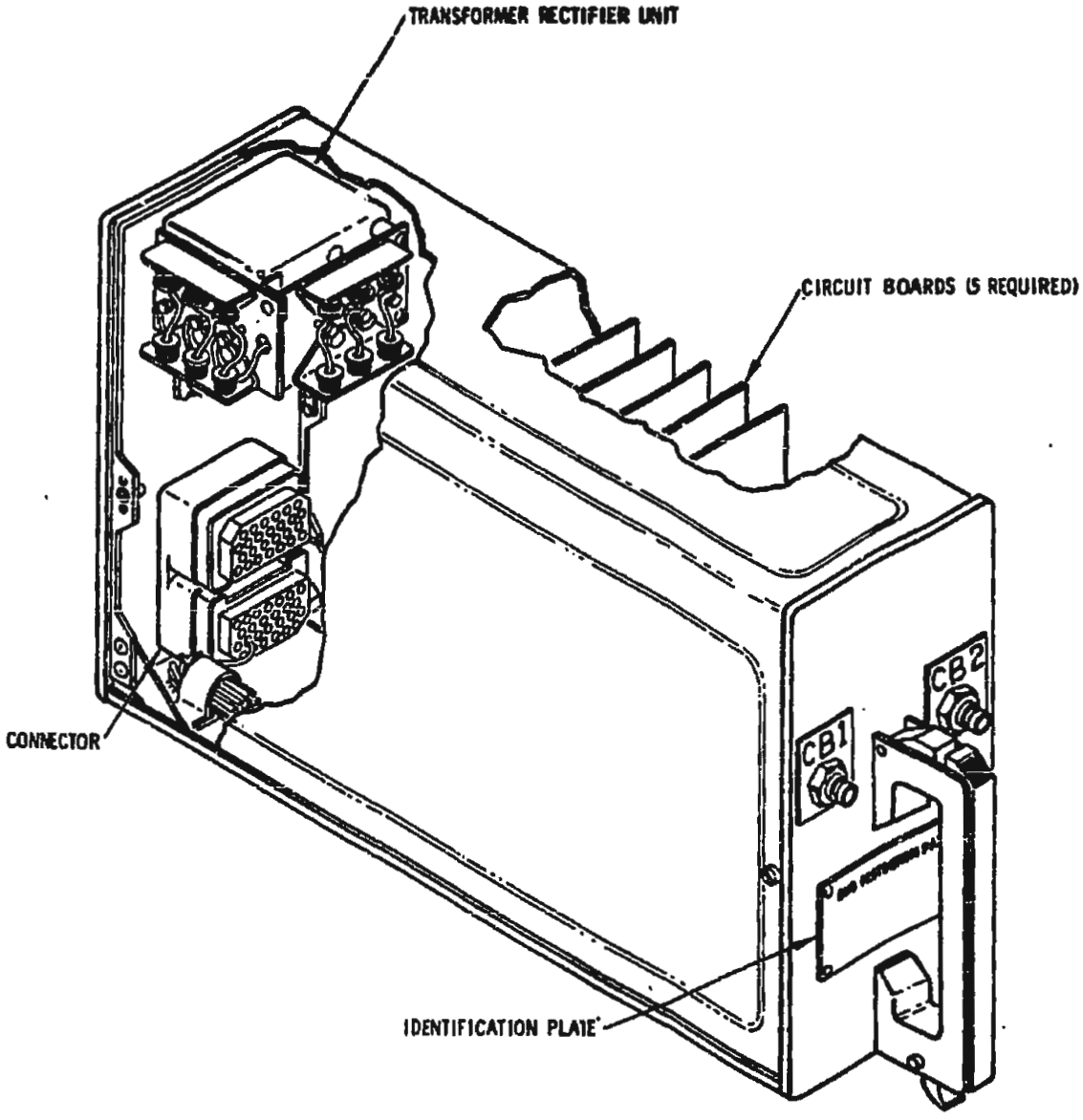
R Differential Protection Current Transformer
R Figure 17



R AC Generation Speed Shutdown System Schematic
R Figure 18

EFFECTIVITY: ALL

0018



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R
R

Bus Protection Panel
Figure 19

R A protection circuit is provided to protect the
R external power feeders from shorts to ground. An
R external power source, which uses the dc voltage
R (supplied by the BPP) on pin F of the external power
R receptacle to control the output, must be used to
R obtain the external power feeder protection provided by
R the aircraft system. The sensing circuit (Ref. Fig.
R 20) consists of two three-phase differential protection
R current transformer (DPCT) assemblies. One DPCT is
R mounted near the external power receptacle, zone 124,
R on the leads to the EPR, and the other is located at
R the load side of the EPR, zone 137. The two DPCT are
R connected to the BPP in a differential configuration.
R The transformer outputs are half-wave rectified and
R summed to give a signal proportional to any difference
R in current between the input and output transformers.
R The signal is applied to a comparator circuit set to
R provide an output signal when a fault current in any
R phase exceeds 50 (±10) amp. The output signal trips
R the EPR and the external power source.

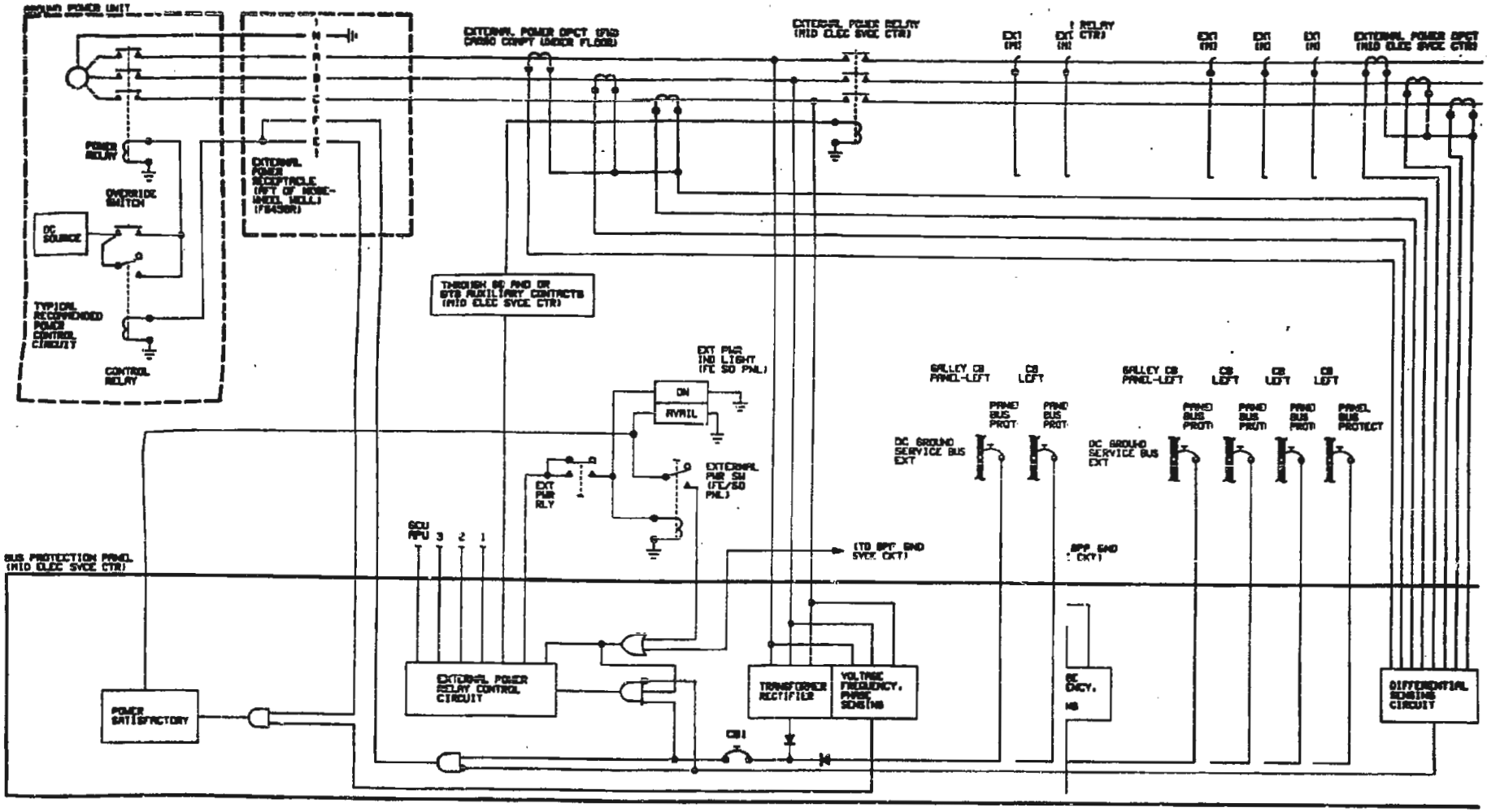
R (3) Phase Sequence Verification

R The phase sequence circuit senses the external power
R line-to-line vector voltages A-C and B-C through two
R transformers. The two voltage vectors are 120 degrees
R apart. The A-C transformer output is applied to a lead
R network which shifts the current 60 degrees, while the
R B-C output is applied to resistive network with no
R current shift. The circuitry places the two currents
R at 180 degrees if the phase rotation is correct. The
R two currents cancel, and no output is available from
R the circuit. If the phase sequence is reversed, the
R two currents are only 60 degrees apart and will sum to
R form an output signal. The signal is fed into an
R inhibiting circuit which prevents application of
R external power.

R (4) Overvoltage Protection

R The overvoltage protection circuit senses the voltage
R on the three phases of the external power and develops
R a signal proportional to the highest phase voltage.
R The signal is applied to a voltage-divider circuit
R which sets the minimum trip level to 130 (±3) volts.
R The voltage divider output is applied to an inverse
R time-delay circuit with a maximum delay of 5 seconds at
R 134 volts. The output from the time delay disables the
R EPR control circuit and opens the relay.

R (5) Undervoltage Protection


GROUND POWER UNIT
POWER RELAY
OVERRIDE SWITCH
DC SOURCE
TYPICAL RECOMMENDED POWER CONTROL CIRCUITRY
CONTROL RELAY
EXTERNAL POWER RECEPTACLE (RT OF NOSE-WHEEL WELL) (P5A5OR)
EXTERNAL POWER DPCT (FWD CARGO COMPT LOWER FLOOR)
EXTERNAL POWER RELAY (MID ELEC SVCE CTR)
THROUGH 80 AND OR 870 AUXILIARY CONTACTS (MID ELEC SVCE CTR)
EXT PWR IND LIGHT (FE SO PNL)
ON
AVAIL
EXT PWR RLY
EXTERNAL PWR SW (FE/SO PNL)
GCU APU 3 2 1
BUS PROTECTION PANEL (MID ELEC SVCE CTR)
POWER SATISFACTORY
EXTERNAL POWER RELAY CONTROL CIRCUIT
TRANSFORMER RECTIFIER
VOLTAGE FREQUENCY, PHASE SENSING
CB1
(TO APT GND SVCE CKT)
APP GND (CKT)
DC GROUND SERVICE BUS EXT
GALLEY CB PANEL-LEFT
CB LEFT
PANEL BUS PROTECT
DIFFERENTIAL SENSING CIRCUIT

R External Power Control and Feeder Protection
R System Simplified Schematic
R Figure 20

EFFECTIVITY: ALL

001B

R The undervoltage protection circuit also senses the
R three-phase external power voltage. The sensing output
R is applied to a comparator circuit which sets the
R pickup voltage at 109 (±2) volts and the dropout
R voltage at 100 (±3) volts. When an undervoltage
R condition is sensed, a 5- to 7-second time delay
R circuit is energized. If the undervoltage continues,
R the EPR will be opened.

R (6) Overfrequency/Underfrequency Protection

R The frequency circuit senses the external power
R frequency and prevents closing (or will open) the EPR
R if the frequency is not within 375 ± 5 Hz to 425 ± 5
R Hz.

R (7) Overcurrent Protection

R A single-phase overcurrent current transformer senses
R the external power current and actuates the overcurrent
R protection circuit if the current reaches 258 to 275
R amp. The protection circuit activates the automatic
R load monitoring system and removes nonessential loads
R from the buses.

R (8) Panel Power Inputs

R A self-contained transformer-rectifier provides the
R panel with operation and control power by rectifying
R the external power. Power is also supplied from the
R aircraft dc ground service bus extension to operate the
R BPP when external power is not available. All control
R and protection functions will operate correctly with
R either or both power inputs. Suppression circuits are
R provided to block out any high-voltage transients which
R might be generated in the using equipment.

R (9) Panel Outputs

R The panel supplies unregulated nominal 28V dc power to
R operate the external power and ground service relays.
R Two circuit breakers mounted on the panel provide
R protection for the panel power supply. One breaker
R protects against internal faults, the second breaker
R protects against external faults. A 28V dc signal is
R also supplied to operate automatic load monitoring of
R the bus distribution system. Other signals are
R supplied to inform the GCU that the external power
R system is operating.

ENGINE-DRIVEN GENERATOR SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 24 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

TABLE 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Engine Driven Generator Fault Isolation (Engine Stopped)
104	Engine Driven Generator Paralleling Fault Isolation (Engine Stopped)
105	PMG Fault Isolation
106	Generator Field Control Fault Isolation
107	Generator Voltage Fault Isolation

(Cont)
TABLE 101

FIGURE	TITLE
108	Generator Breaker Control Fault Isolation
109	Generator Load Control Fault Isolation
110	Generator Underspeed Control Fault Isolation
111	Engine Driven Generator Paralleling Fault Isolation (Engine Running)
112A	Engine Driven Generator DIFF Light On Fault Isolation
112B	APU DIFF Light On Fault Isolation
113	Bus Tie Breaker Control Fault Isolation
SCHEM 1	Generator Field Control and Indication Schematic
SCHEM 2	Generator Breaker Control and Indication Schematic
SCHEM 3	AC Bus Tie Breaker Control and Indication Schematic
SCHEM 4	Real Load Division Schematic
SCHEM 5	Generator Preferential Circuit Schematic
SCHEM 6	Voltage and Frequency Indication Schematic
SCHEM 7	KW/KVAR Indicating System Schematic
SCHEM 8	Generator Feeder System Schematic
SCHEM 9	Differential Protection Schematic
SCHEM 10	PMG System Schematic
SCHEM 11	Generation Speed Shutdown Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
APU GENERATOR AND ADAPTER	1	APU COMP/319CL	24-14-01
BTB 1, 2, 3	3	MESC; PWR DIST PNL/192K	24-21-07
BUS PROTECTION PANEL	1	MESC, L RACK/192K	24-20-03
CIRCUIT BREAKERS			
AC STANDBY BUS SENSE (2432-CB15)	1	PILOTS OVHD CB1 PANEL/210	*
GEN CONTROL UNIT, GEN 1 (2421-CB1)	1	PILOTS OVHD CB1 PANEL/210	*
GEN CONTROL UNIT, GEN 2 (2421 CB2)	1	PILOTS OVHD CB1 PANEL/210	*
GEN CONTROL UNIT, GEN 3 (2421 CB3)	1	PILOTS OVHD CB1 PANEL/210	*
APU GEN CONTROL UNIT (2424-CB1)	1	FE/SO AFT CB3 PANEL/215	*
AC PWR, LOAD CONTROL AND FAIL IND, BUS 1: (2451-CB1)	1	FE/SO AFT CB3 PANEL/215	*
AC PWR, LOAD CONTROL AND FAIL IND, BUS 2: (2451-CB2)	1	FE/SO AFT CB3 PANEL/215	*
AC PWR, LOAD CONTROL AND FAIL IND, BUS 3: (2451-CB3)	1	FE/SO AFT CB3 PANEL/215	*
ELECTRIC METER SWITCH (2400-CB2)	1	FE/SO AFT CB3 PANEL/215	*
PANEL BUS PROTECT (2441-CB2)	1	GALLEY LEFT CB PANEL	*
ELECTRONIC CONTROL UNIT	1	AEEA/162BR	49-00-02
FREQUENCY METER	1	FE/SO PANEL/P12	24-21-11
GB, GENERATOR 1, 2, 3	3	MESC, PWR DIST PNL/192K	24-21-07
GENERATOR CONTROL UNIT, IDG	3	MESC/192K	24-21-05
GOVERNOR CONSTANT SPEED DRIVE	3	ON IDG/413A, 423A, 433AL	24-11-01
IDG - NO. 1, 3	2	413A, 423A	24-11-01
IDG - NO. 2	1	433AL, 193AR	24-11-01
INDICATOR LIGHTS CONTROL BOX	1	FESC; AFT OF ELEC RACK/112AB	33-17-04

*SEE G.M.E.O. EQUIPMENT LIST

511 0XX0 24 404

R Component Location Index
R Figure 101 (Sheet 1)

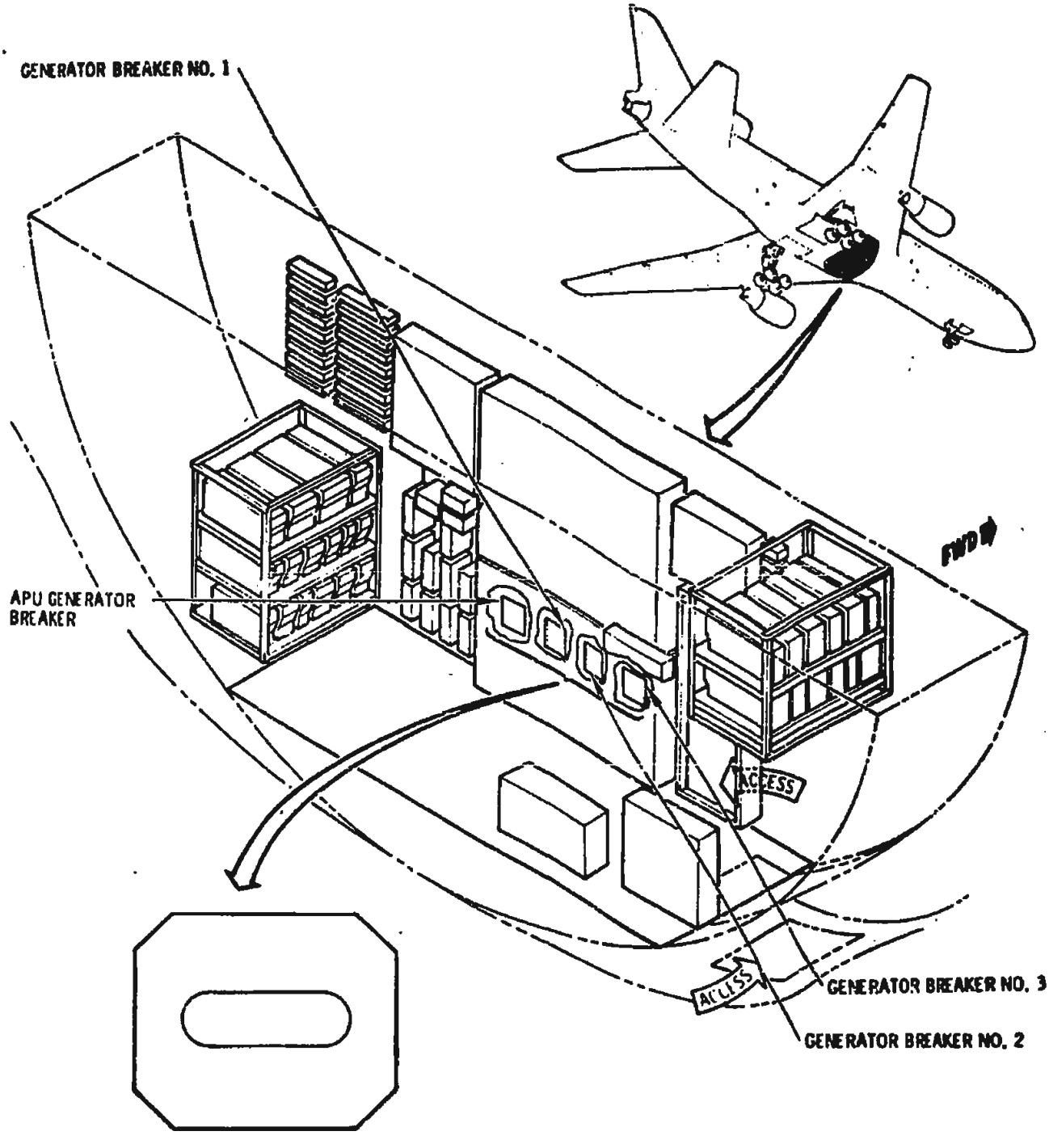
EFFECTIVITY: ALL

001B

COMPONENT	QTY	AREA/ACCESS	REFERENCE
KW/KVAR METER	3	FE/SO PANEL; P12	24-21-08
REAL LOAD CONTROLLER, IDG	3	MESC; 192K	24-11-11
SWITCH – CHARGE AND UNDERSPEED	3	ON IDG; 413A, 423A, 433AL	24-11-06
SWITCHLIGHTS, GENERATOR BREAKER CLOSE	4	FE/SO PANEL; P12	20-33-01
SWITCHLIGHTS, GENERATOR BREAKER TRIP	4	FE/SO PANEL; P12	20-33-01
TRANSFORMER, CURRENT	1	319CL	49-51-08
TRANSFORMER, GENERATOR CURRENT	4	MESC; 192K	24-21-06
TRANSFORMER, GENERATOR DP	5	MESC; 192K	24-21-16
VOLTMETER	1	FE/SO PANEL, P12	24-21-10

M1-0000-24-405

R Component Location Index
R Figure 101 (Sheet 2)



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R
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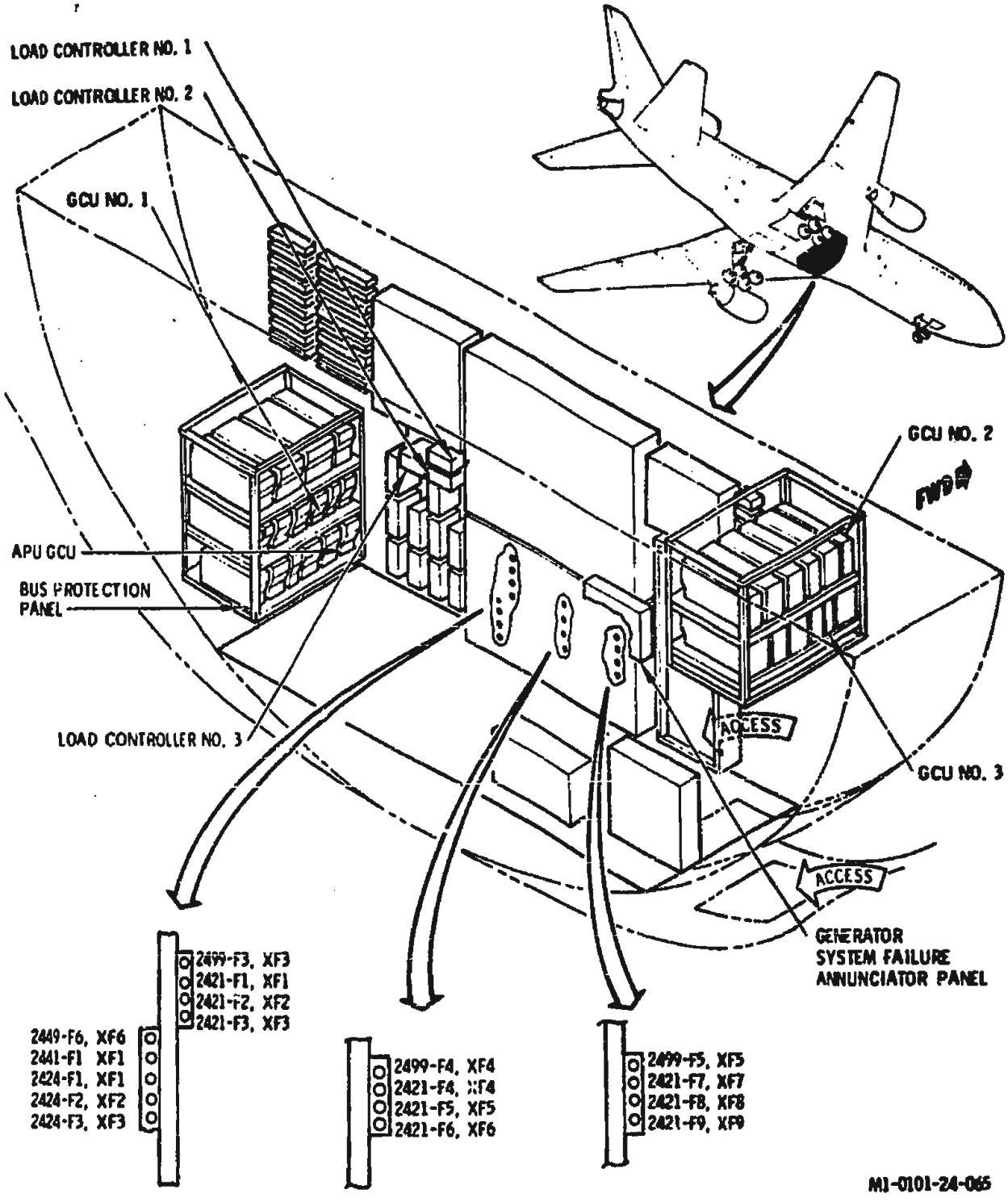
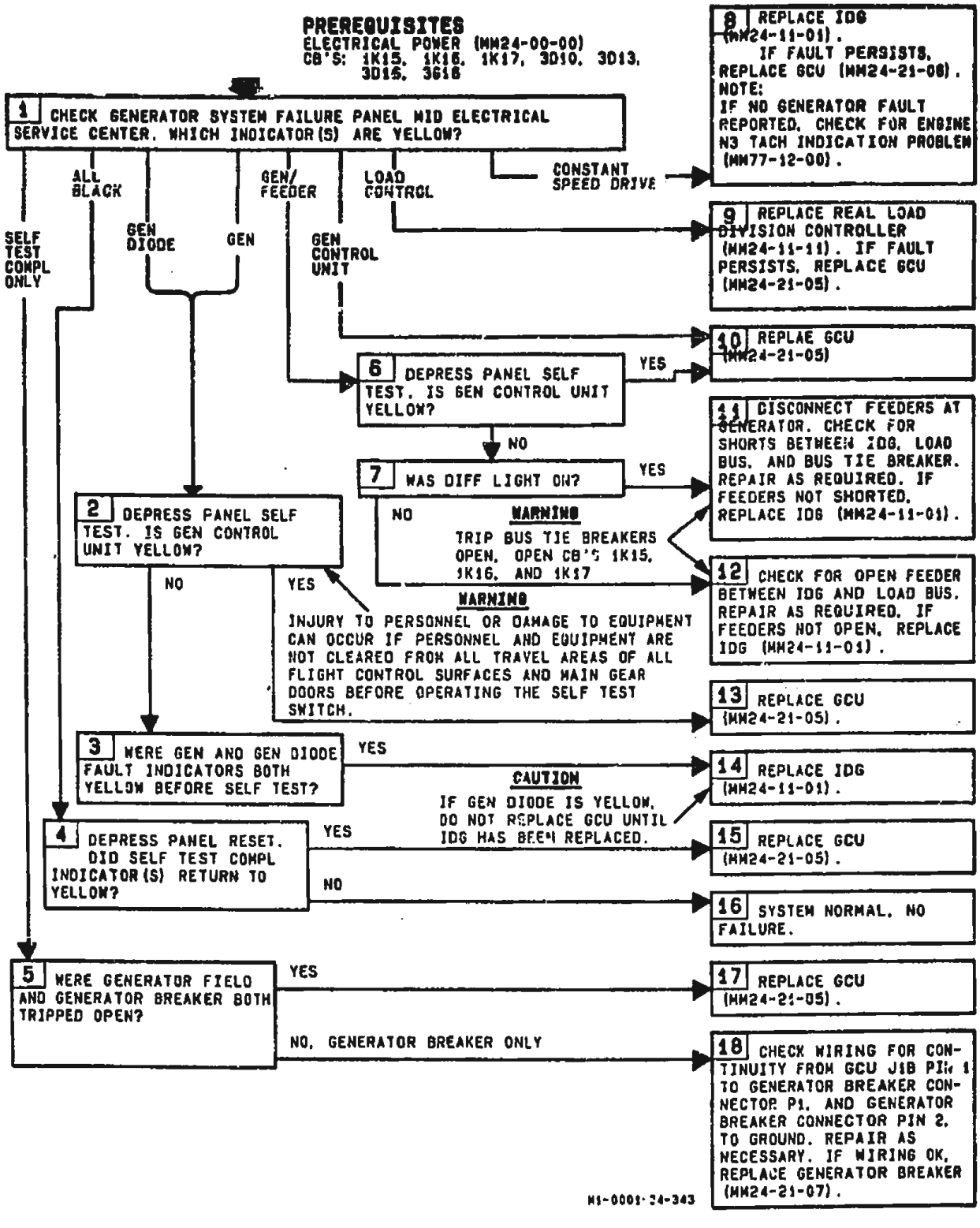
Component Locator Diagram
Figure 102 (Sheet 1)

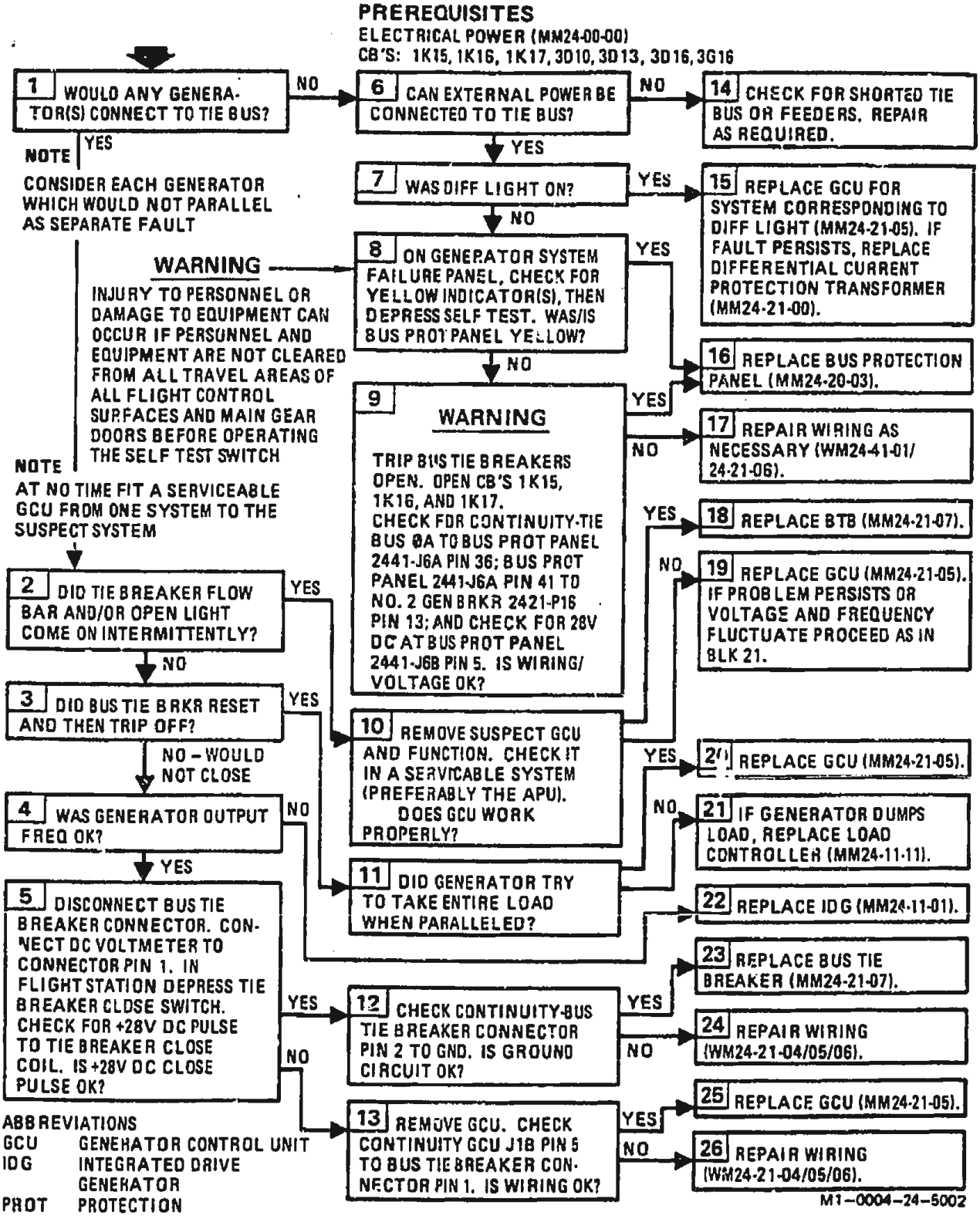


R Component Locator Diagram
R Figure 102 (Sheet 2)

EFFECTIVITY: ALL


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 1K15, 1K16, 1K17, 3D10, 3D13, 3D15, 3G16
1 CHECK GENERATOR SYSTEM FAILURE PANEL MID ELECTRICAL SERVICE CENTER. WHICH INDICATOR(S) ARE YELLOW?
CONSTANT SPEED DRIVE
ALL BLACK
GEN/ FEEDER
LOAD CONTROL
SELF TEST COMPL ONLY
GEN DIODE
GEN
GEN CONTROL UNIT
8 REPLACE IDG (MM24-11-01). IF FAULT PERSISTS, REPLACE GCU (MM24-21-06). NOTE: IF NO GENERATOR FAULT REPORTED, CHECK FOR ENGINE N3 TACH INDICATION PROBLEM (MM77-12-00).
9 REPLACE REAL LOAD DIVISION CONTROLLER (MM24-11-11). IF FAULT PERSISTS, REPLACE GCU (MM24-21-05).
10 REPLAE GCU (MM24-21-05)
6 DEPRESS PANEL SELF TEST. IS GEN CONTROL UNIT YELLOW?
YES
NO
7 WAS DIFF LIGHT ON?
YES
11 DISCONNECT FEEDERS AT GENERATOR. CHECK FOR SHORTS BETWEEN IDG, LOAD BUS, AND BUS TIE BREAKER. REPAIR AS REQUIRED. IF FEEDERS NOT SHORTED, REPLACE IDG (MM24-11-01).
2 DEPRESS PANEL SELF TEST. IS GEN CONTROL UNIT YELLOW?
NO
WARNING
TRIP BUS TIE BREAKERS OPEN. OPEN CB'S 1K15, 1K16, AND 1K17
12 CHECK FOR OPEN FEEDER BETWEEN IDG AND LOAD BUS. REPAIR AS REQUIRED. IF FEEDERS NOT OPEN, REPLACE IDG (MM24-11-01).
YES
WARNING
INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE SELF TEST SWITCH.
13 REPLACE GCU (MM24-21-05).
3 WERE GEN AND GEN DIODE FAULT INDICATORS BOTH YELLOW BEFORE SELF TEST?
YES
14 REPLACE IDG (MM24-11-01).
CAUTION
IF GEN DIODE IS YELLOW, DO NOT REPLACE GCU UNTIL IDG HAS BEEN REPLACED.
4 DEPRESS PANEL RESET. DID SELF TEST COMPL INDICATOR(S) RETURN TO YELLOW?
YES
15 REPLACE GCU (MM24-21-05).
NO
16 SYSTEM NORMAL, NO FAILURE.
5 WERE GENERATOR FIELD AND GENERATOR BREAKER BOTH TRIPPED OPEN?
YES
17 REPLACE GCU (MM24-21-05).
NO, GENERATOR BREAKER ONLY
18 CHECK WIRING FOR CONTINUITY FROM GCU J1B PIN 1 TO GENERATOR BREAKER CONNECTOR P1, AND GENERATOR BREAKER CONNECTOR PIN 2, TO GROUND. REPAIR AS NECESSARY. IF WIRING OK, REPLACE GENERATOR BREAKER (MM24-21-07).
M1-0001-24-343

R Engine Driven Generator Fault Isolation (Engine Stopped)
R Figure 103

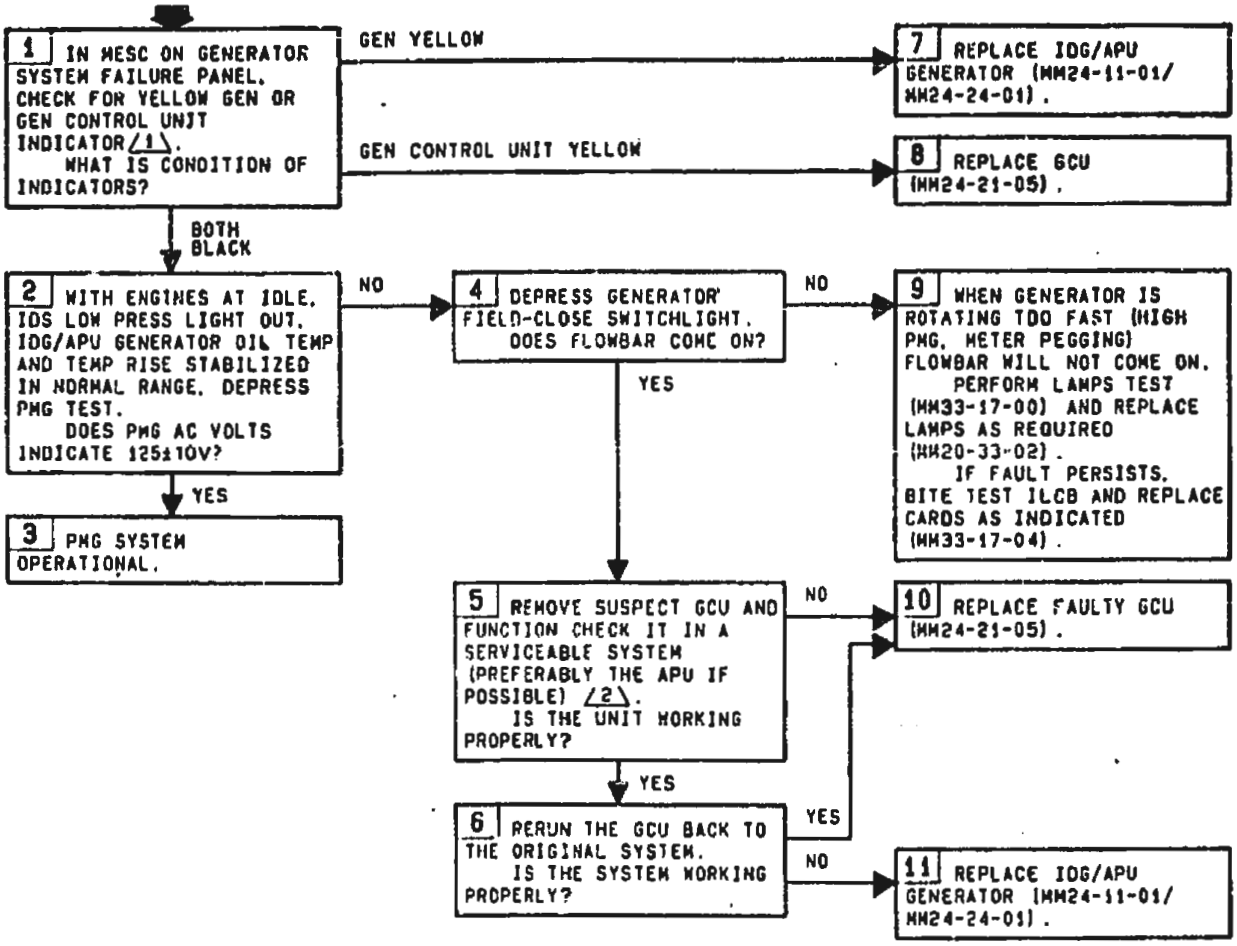

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S: 1K15, 1K16, 1K17, 3D10, 3D13, 3D16, 3G16
1 WOULD ANY GENERATOR(S) CONNECT TO TIE BUS?
NO
6 CAN EXTERNAL POWER BE CONNECTED TO TIE BUS?
NO
14 CHECK FOR SHORTED TIE BUS OR FEEDERS. REPAIR AS REQUIRED.
YES
NOTE
CONSIDER EACH GENERATOR WHICH WOULD NOT PARALLEL AS SEPARATE FAULT
YES
7 WAS DIFF LIGHT ON?
YES
15 REPLACE GCU FOR SYSTEM CORRESPONDING TO DIFF LIGHT (MM24-21-05). IF FAULT PERSISTS, REPLACE DIFFERENTIAL CURRENT PROTECTION TRANSFORMER (MM24-21-00).
NO
WARNING
INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE SELF TEST SWITCH
8 ON GENERATOR SYSTEM FAILURE PANEL, CHECK FOR YELLOW INDICATOR(S), THEN DEPRESS SELF TEST. WAS/IS BUS PROT PANEL YELLOW?
YES
16 REPLACE BUS PROTECTION PANEL (MM24-20-03).
NO
NOTE
AT NO TIME FIT A SERVICEABLE GCU FROM ONE SYSTEM TO THE SUSPECT SYSTEM
9
WARNING
TRIP BUS TIE BREAKERS OPEN. OPEN CB'S 1K15, 1K16, AND 1K17.
CHECK FOR CONTINUITY-TIE BUS ØA TO BUS PROT PANEL 2441-J6A PIN 36; BUS PROT PANEL 2441-J6A PIN 41 TO NO. 2 GEN BRKR 2421-P16 PIN 13; AND CHECK FOR 28V DC AT BUS PROT PANEL 2441-J6B PIN 5. IS WIRING/VOLTAGE OK?
YES
17 REPAIR WIRING AS NECESSARY (WM24-41-01/24-21-06).
NO
YES
18 REPLACE BTB (MM24-21-07).
NO
19 REPLACE GCU (MM24-21-05). IF PROBLEM PERSISTS OR VOLTAGE AND FREQUENCY FLUCTUATE PROCEED AS IN BLK 21.
2 DID TIE BREAKER FLOW BAR AND/OR OPEN LIGHT COME ON INTERMITTENTLY?
YES
NO
3 DID BUS TIE BRKR RESET AND THEN TRIP OFF?
YES
NO – WOULD NOT CLOSE
10 REMOVE SUSPECT GCU AND FUNCTION. CHECK IT IN A SERVICABLE SYSTEM (PREFERABLY THE APU). DOES GCU WORK PROPERLY?
YES
20 REPLACE GCU (MM24-21-05).
NO
21 IF GENERATOR DUMPS LOAD, REPLACE LOAD CONTROLLER (MM24-11-11).
4 WAS GENERATOR OUTPUT FREQ OK?
NO
YES
11 DID GENERATOR TRY TO TAKE ENTIRE LOAD WHEN PARALLELED?
YES
NO
22 REPLACE IDG (MM24-11-01).
5 DISCONNECT BUS TIE BREAKER CONNECTOR. CONNECT DC VOLTMETER TO CONNECTOR PIN 1. IN FLIGHT STATION DEPRESS TIE BREAKER CLOSE SWITCH. CHECK FOR +28V DC PULSE TO TIE BREAKER CLOSE COIL. IS +28V DC CLOSE PULSE OK?
YES
12 CHECK CONTINUITY-BUS TIE BREAKER CONNECTOR PIN 2 TO GND. IS GROUND CIRCUIT OK?
YES
23 REPLACE BUS TIE BREAKER (MM24-21-07).
NO
24 REPAIR WIRING (WM24-21-04/05/06).
NO
13 REMOVE GCU. CHECK CONTINUITY GCU J1B PIN 5 TO BUS TIE BREAKER CONNECTOR PIN 1. IS WIRING OK?
YES
25 REPLACE GCU (MM24-21-05).
NO
26 REPAIR WIRING (WM24-21-04/05/06).
ABBREVIATIONS
GCU GENERATOR CONTROL UNIT
IDG INTEGRATED DRIVE GENERATOR
PROT PROTECTION
M1-0004-24-5002

R Engine Driven Generator Paralleling Fault Isolation (Engine Stopped)
R Figure 104

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
GENERATOR OPERATING (MM24-21-00/MM24-24-00)
GENERATOR NOT PARALLELED
CB'S: 1K10, 1K15, 1K16, 1K17,
3B17, 3D10, 3D13, 3D16, 3B16

PMG FAULT ISOLATION


1 IN MESC ON GENERATOR SYSTEM FAILURE PANEL, CHECK FOR YELLOW GEN OR GEN CONTROL UNIT INDICATOR /1\. WHAT IS CONDITION OF INDICATORS?
GEN YELLOW
7 REPLACE IDG/APU GENERATOR (MM24-11-01/ MM24-24-01).
GEN CONTROL UNIT YELLOW
8 REPLACE GCU (MM24-21-05).
BOTH BLACK
2 WITH ENGINES AT IDLE, IDS LOW PRESS LIGHT OUT, IDG/APU GENERATOR OIL TEMP AND TEMP RISE STABILIZED IN NORMAL RANGE, DEPRESS PMG TEST. DOES PMG AC VOLTS INDICATE 125±10V?
NO
4 DEPRESS GENERATOR FIELD-CLOSE SWITCHLIGHT. DOES FLOWBAR COME ON?
NO
9 WHEN GENERATOR IS ROTATING TOO FAST (HIGH PMG, METER PEGGING) FLOWBAR WILL NOT COME ON. PERFORM LAMPS TEST (MM33-17-00) AND REPLACE LAMPS AS REQUIRED (MM20-33-02). IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
YES
YES
3 PMG SYSTEM OPERATIONAL.
5 REMOVE SUSPECT GCU AND FUNCTION CHECK IT IN A SERVICEABLE SYSTEM (PREFERABLY THE APU IF POSSIBLE) /2\. IS THE UNIT WORKING PROPERLY?
NO
10 REPLACE FAULTY GCU (MM24-21-05).
YES
6 RERUN THE GCU BACK TO THE ORIGINAL SYSTEM. IS THE SYSTEM WORKING PROPERLY?
YES
NO
11 REPLACE IDG/APU GENERATOR (MM24-11-01/ MM24-24-01).

NOTE

/1\ ALL FAILURES WHICH THIS PANEL ANNUNCIATES CAN BE DETECTED WITHOUT GENERATOR OPERATING IF PANEL HAS NOT BEEN RESET SINCE THE FAILURE OCCURED.

/2\ AT NO TIME FIT A SERVICEABLE UNIT FROM ANOTHER SYSTEM TO THE SUSPECT SYSTEM.

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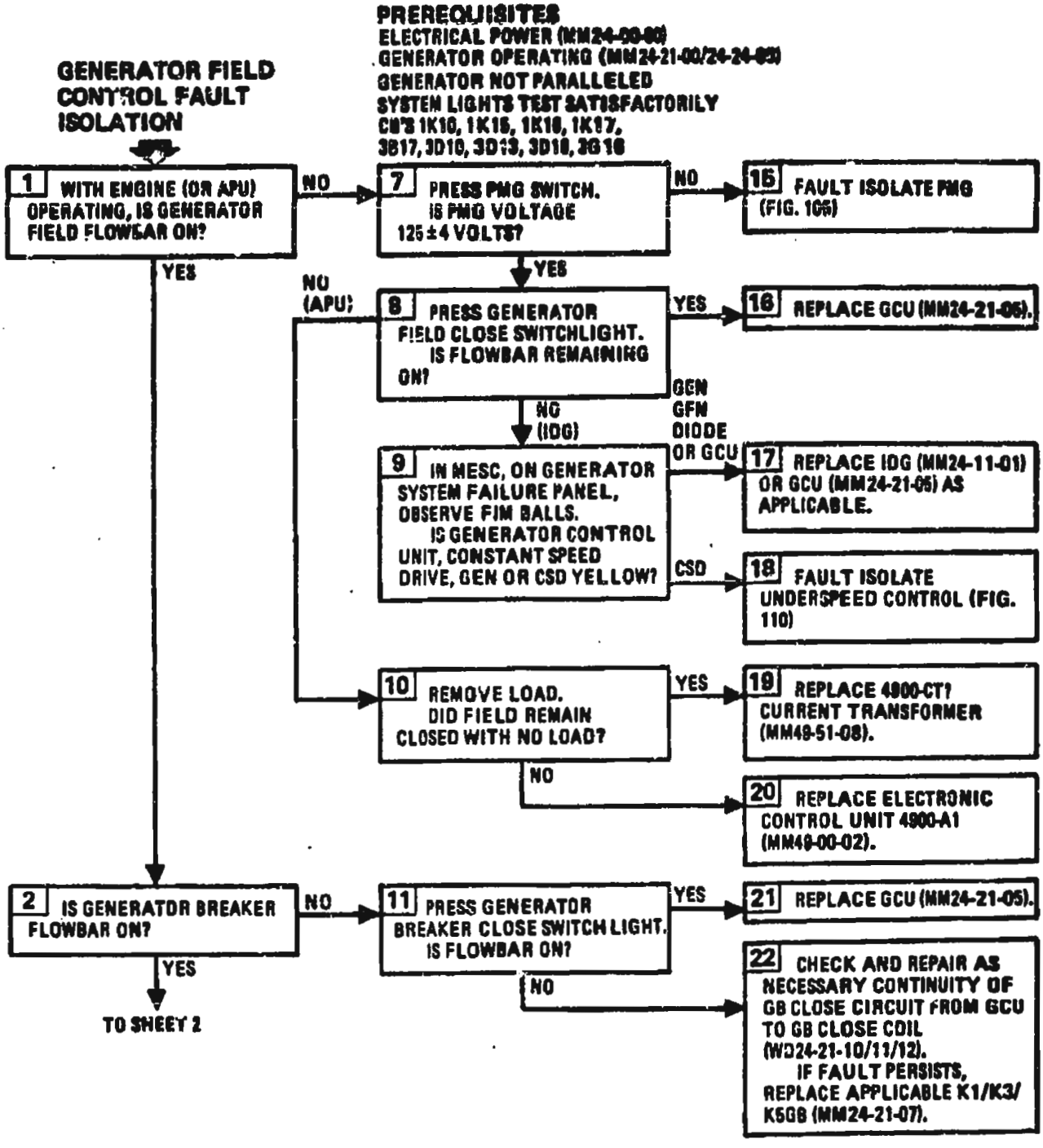
CR

PMG Fault Isolation
Figure 105

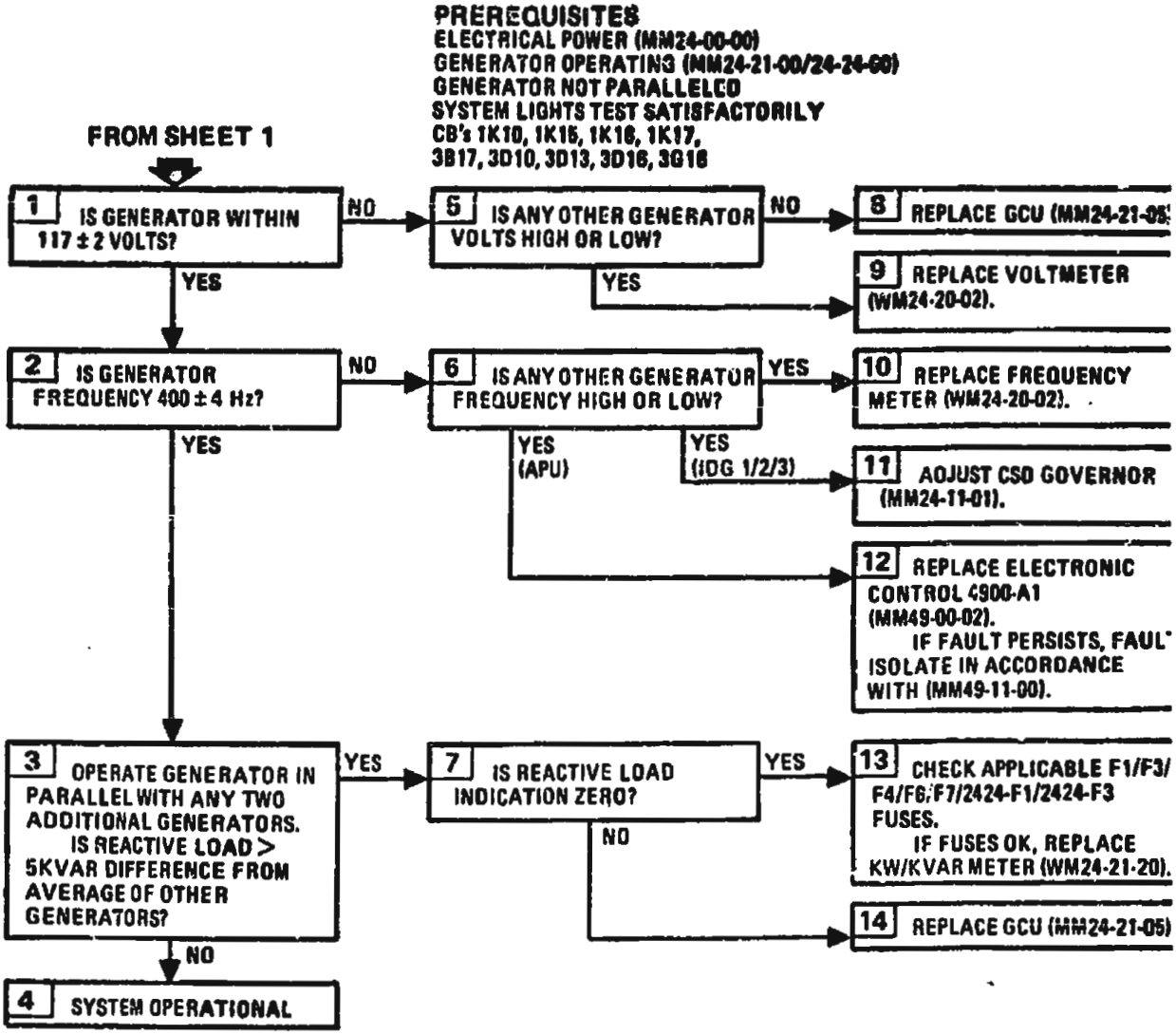
EFFECTIVITY: ALL

001B


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
GENERATOR OPERATING (MM24-21-00/24-24-00)
GENERATOR NOT PARALLELED
SYSTEM LIGHTS TEST SATISFACTORILY
CB'S 1K10, 1K15, 1K16, 1K17, 3B17, 3D10, 3D13, 3D18, 3G16
GENERATOR FIELD CONTROL FAULT ISOLATION
1 WITH ENGINE (OR APU) OPERATING, IS GENERATOR FIELD FLOWBAR ON?
NO
YES
7 PRESS PMG SWITCH. IS PMG VOLTAGE 125±4 VOLTS?
NO
15 FAULT ISOLATE PMG (FIG. 105)
YES
NO (APU)
8 PRESS GENERATOR FIELD CLOSE SWITCHLIGHT. IS FLOWBAR REMAINING ON?
YES
16 REPLACE GCU (MM24-21-05).
NO (IDG)
GEN GFN DIODE OR GCU
9 IN MESC, ON GENERATOR SYSTEM FAILURE PANEL, OBSERVE FIM BALLS. IS GENERATOR CONTROL UNIT, CONSTANT SPEED DRIVE, GEN OR CSD YELLOW?
17 REPLACE IDG (MM24-11-01) OR GCU (MM24-21-05) AS APPLICABLE.
CSD
18 FAULT ISOLATE UNDERSPEED CONTROL (FIG. 110)
10 REMOVE LOAD. DID FIELD REMAIN CLOSED WITH NO LOAD?
YES
19 REPLACE 4900-CT1 CURRENT TRANSFORMER (MM49-51-08).
NO
20 REPLACE ELECTRONIC CONTROL UNIT 4900-A1 (MM49-00-02).
2 IS GENERATOR BREAKER FLOWBAR ON?
NO
11 PRESS GENERATOR BREAKER CLOSE SWITCH LIGHT. IS FLOWBAR ON?
YES
21 REPLACE GCU (MM24-21-05).
YES
TO SHEET 2
NO
22 CHECK AND REPAIR AS NECESSARY CONTINUITY OF GB CLOSE CIRCUIT FROM GCU TO GB CLOSE COIL (WD24-21-10/11/12). IF FAULT PERSISTS, REPLACE APPLICABLE K1/K3/K5GB (MM24-21-07).

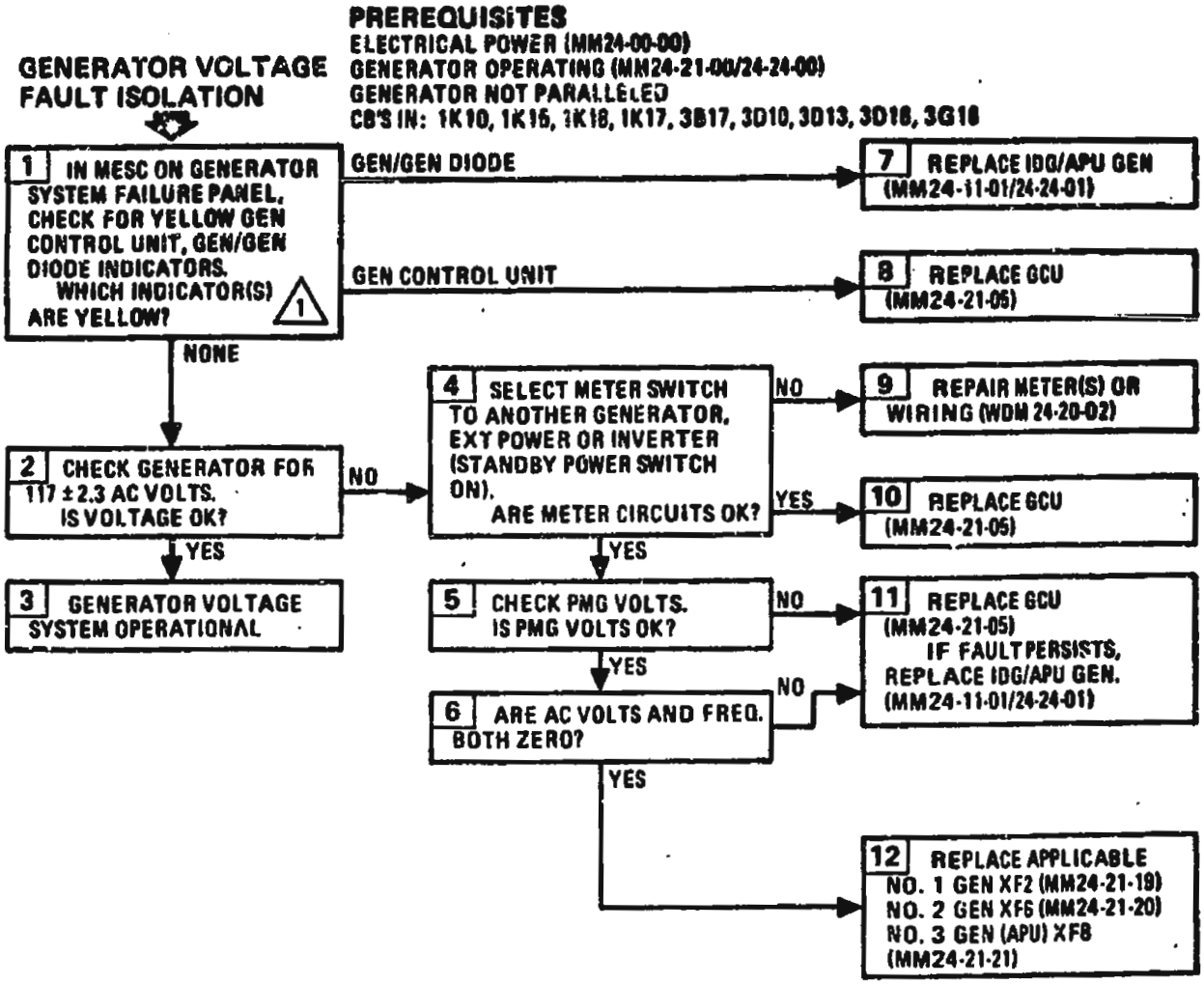
M1-0004-24-575

R Generator Field Control Fault Isolation
R Figure 106 (Sheet 1)


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
GENERATOR OPERATING (MM24-21-00/24-24-00)
GENERATOR NOT PARALLELED
SYSTEM LIGHTS TEST SATISFACTORILY
CB's 1K10, 1K15, 1K16, 1K17,
3B17, 3D10, 3D13, 3D16, 3G16
FROM SHEET 1
1 IS GENERATOR WITHIN 117 ± 2 VOLTS?
NO
YES
5 IS ANY OTHER GENERATOR VOLTS HIGH OR LOW?
NO
YES
8 REPLACE GCU (MM24-21-05
9 REPLACE VOLTMETER (WM24-20-02).
2 IS GENERATOR FREQUENCY 400 ± 4 Hz?
NO
YES
6 IS ANY OTHER GENERATOR FREQUENCY HIGH OR LOW?
YES
10 REPLACE FREQUENCY METER (WM24-20-02).
YES (APU)
YES (IDG 1/2/3)
11 AOJUST CSD GOVERNOR (MM24-11-01).
12 REPLACE ELECTRONIC CONTROL 4900-A1 (MM49-00-02).
IF FAULT PERSISTS, FAUL ISOLATE IN ACCORDANCE WITH (MM49-11-00).
3 OPERATE GENERATOR IN PARALLEL WITH ANY TWO ADDITIONAL GENERATORS.
IS REACTIVE LOAD > 5KVAR DIFFERENCE FROM AVERAGE OF OTHER GENERATORS?
YES
7 IS REACTIVE LOAD INDICATION ZERO?
YES
NO
13 CHECK APPLICABLE F1/F3/ F4/F6/F7/2424-F1/2424-F3 FUSES.
IF FUSES OK, REPLACE KW/KVAR METER (WM24-21-20).
NO
4 SYSTEM OPERATIONAL
14 REPLACE GCU (MM24-21-05)

M1-0001-24-407

R Generator Field Control Fault Isolation
R Figure 106 (Sheet 2)


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
GENERATOR OPERATING (MM24-21-00/24-24-00)
GENERATOR NOT PARALLELED
CB'S IN: 1K10, 1K16, 1K18, 1K17, 3B17, 3D10, 3D13, 3D18, 3G18
GENERATOR VOLTAGE FAULT ISOLATION
1 IN MESC ON GENERATOR SYSTEM FAILURE PANEL, CHECK FOR YELLOW GEN CONTROL UNIT, GEN/GEN DIODE INDICATORS. WHICH INDICATOR(S) ARE YELLOW? 1
GEN/GEN DIODE
7 REPLACE IDG/APU GEN (MM24-11-01/24-24-01)
GEN CONTROL UNIT
8 REPLACE GCU (MM24-21-05)
NONE
2 CHECK GENERATOR FOR 117 ±2.3 AC VOLTS. IS VOLTAGE OK?
NO
4 SELECT METER SWITCH TO ANOTHER GENERATOR, EXT POWER OR INVERTER (STANDBY POWER SWITCH ON). ARE METER CIRCUITS OK?
NO
9 REPAIR METER(S) OR WIRING (WDM 24-20-02)
YES
10 REPLACE GCU (MM24-21-05)
YES
3 GENERATOR VOLTAGE SYSTEM OPERATIONAL
5 CHECK PMG VOLTS. IS PMG VOLTS OK?
NO
11 REPLACE GCU (MM24-21-05) IF FAULT PERSISTS, REPLACE IDG/APU GEN. (MM24-11-01/24-24-01)
YES
6 ARE AC VOLTS AND FREQ. BOTH ZERO?
NO
YES
12 REPLACE APPLICABLE NO. 1 GEN XF2 (MM24-21-19) NO. 2 GEN XF6 (MM24-21-20) NO. 3 GEN (APU) XF8 (MM24-21-21)

1 NOTE
ALL FAILURES WHICH THIS PANEL ANNUNCIATES CAN BE DETECTED WITHOUT GENERATOR OPERATING IF PANEL HAS NOT BEEN RESET SINCE THE FAILURE OCCURED

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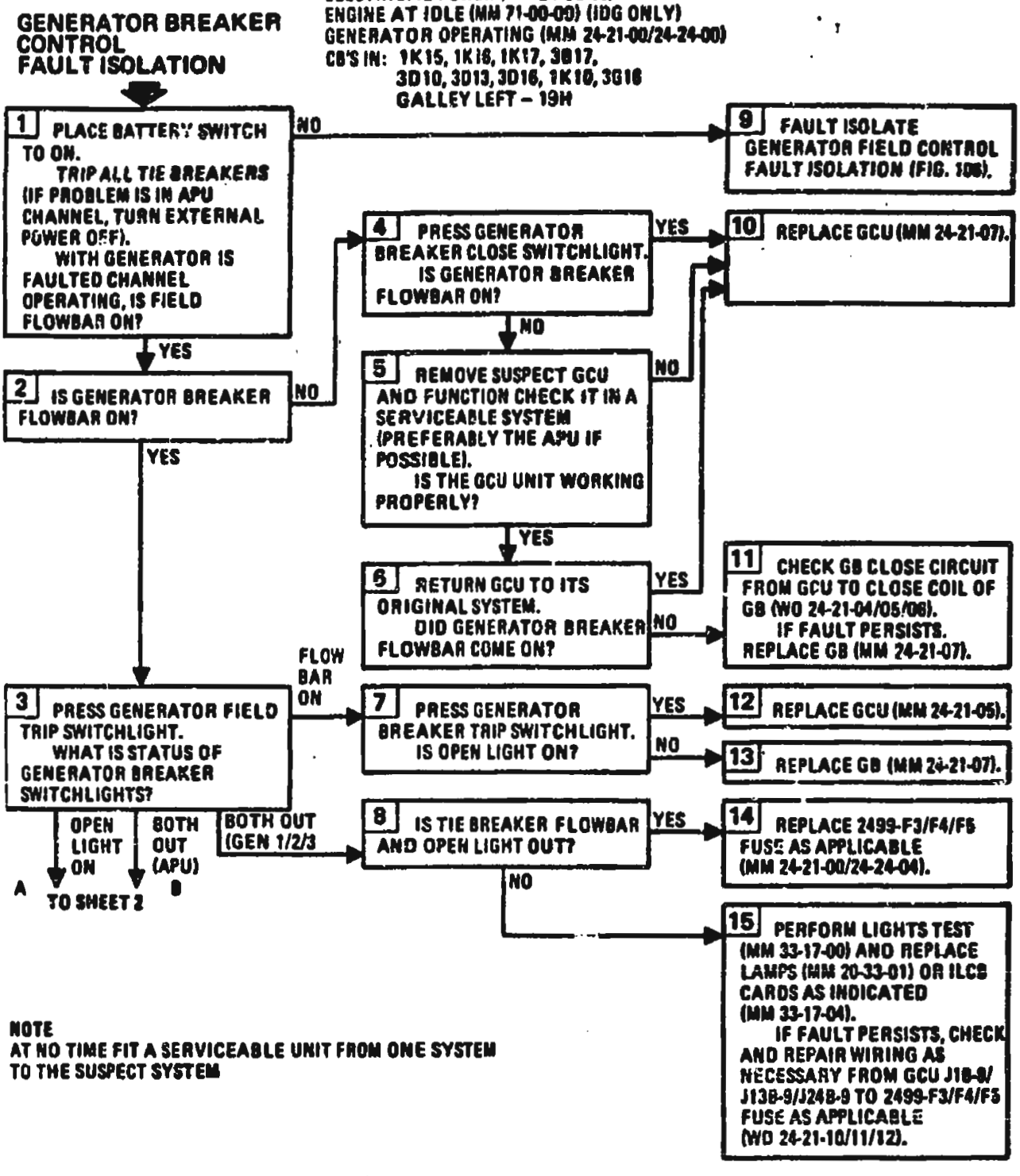
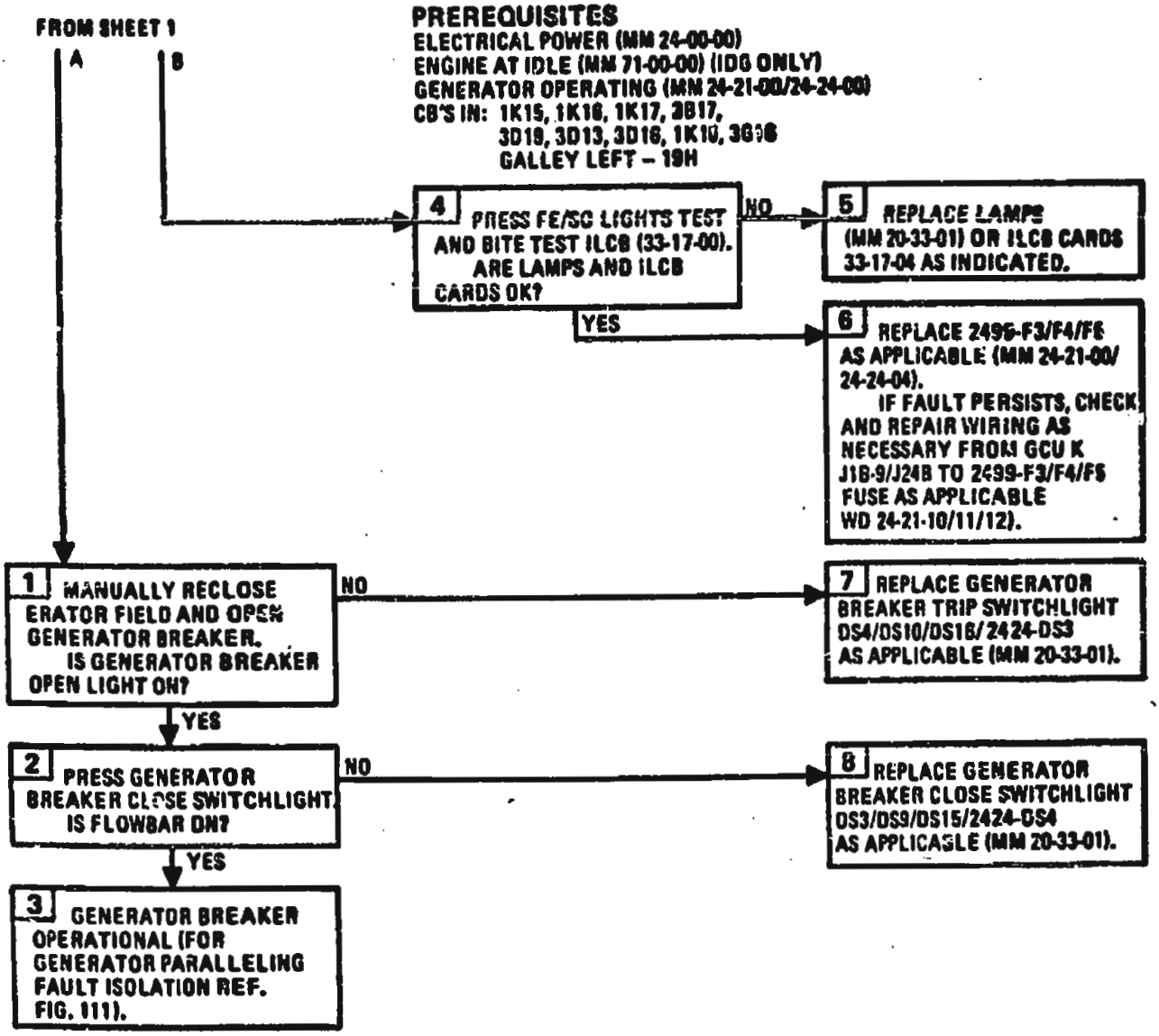
Generator Voltage Fault Isolation
Figure 107


GENERATOR BREAKER CONTROL FAULT ISOLATION
PREREQUISITES
ELECTRICAL POWER (MM 24-00-00)
ENGINE AT IDLE (MM 71-00-00) (IDG ONLY)
GENERATOR OPERATING (MM 24-21-00/24-24-00)
CB'S IN: 1K15, 1K16, 1K17, 3B17, 3D10, 3D13, 3D16, 1K10, 3G16
GALLEY LEFT – 19H
1 PLACE BATTERY SWITCH TO ON.
TRIP ALL TIE BREAKERS (IF PROBLEM IS IN APU CHANNEL, TURN EXTERNAL POWER OFF).
WITH GENERATOR IS FAULTED CHANNEL OPERATING, IS FIELD FLOWBAR ON?
NO
9 FAULT ISOLATE GENERATOR FIELD CONTROL FAULT ISOLATION (FIG. 106).
YES
2 IS GENERATOR BREAKER FLOWBAR ON?
NO
4 PRESS GENERATOR BREAKER CLOSE SWITCHLIGHT.
IS GENERATOR BREAKER FLOWBAR ON?
YES
10 REPLACE GCU (MM 24-21-07).
NO
5 REMOVE SUSPECT GCU AND FUNCTION CHECK IT IN A SERVICEABLE SYSTEM (PREFERABLY THE APU IF POSSIBLE).
IS THE GCU UNIT WORKING PROPERLY?
NO
YES
6 RETURN GCU TO ITS ORIGINAL SYSTEM.
DID GENERATOR BREAKER FLOWBAR COME ON?
YES
NO
11 CHECK GB CLOSE CIRCUIT FROM GCU TO CLOSE COIL OF GB (WD 24-21-04/05/06).
IF FAULT PERSISTS, REPLACE GB (MM 24-21-07).
YES
3 PRESS GENERATOR FIELD TRIP SWITCHLIGHT.
WHAT IS STATUS OF GENERATOR BREAKER SWITCHLIGHTS?
FLOW BAR ON
7 PRESS GENERATOR BREAKER TRIP SWITCHLIGHT.
IS OPEN LIGHT ON?
YES
12 REPLACE GCU (MM 24-21-05).
NO
13 REPLACE GB (MM 24-21-07).
OPEN LIGHT ON
A
TO SHEET 2
BOTH OUT (APU)
B
BOTH OUT (GEN 1/2/3
8 IS TIE BREAKER FLOWBAR AND OPEN LIGHT OUT?
YES
14 REPLACE 2499-F3/F4/F5 FUSE AS APPLICABLE (MM 24-21-00/24-24-04).
NO
15 PERFORM LIGHTS TEST (MM 33-17-00) AND REPLACE LAMPS (MM 20-33-01) OR ILCS CARDS AS INDICATED (MM 33-17-04).
IF FAULT PERSISTS, CHECK AND REPAIR WIRING AS NECESSARY FROM GCU J18-9/J13B-9/J24B-9 TO 2499-F3/F4/F5 FUSE AS APPLICABLE (WD 24-21-10/11/12).
NOTE
AT NO TIME FIT A SERVICEABLE UNIT FROM ONE SYSTEM TO THE SUSPECT SYSTEM
M1-0001-24-382

R R Generator Breaker Control Fault Isolation
Figure 108 (Sheet 1)

EFFECTIVITY: ALL

0018


FROM SHEET 1
A
B
PREREQUISITES
ELECTRICAL POWER (MM 24-00-00)
ENGINE AT IDLE (MM 71-00-00) (IDG ONLY)
GENERATOR OPERATING (MM 24-21-00/24-24-00)
CB'S IN: 1K15, 1K16, 1K17, 3B17,
3D19, 3D13, 3D16, 1K10, 3G16
GALLEY LEFT – 19H
4 PRESS FE/SC LIGHTS TEST AND BITE TEST ILCB (33-17-00). ARE LAMPS AND ILCB CARDS OK?
NO
5 REPLACE LAMPS (MM 20-33-01) OR ILCB CARDS 33-17-04 AS INDICATED.
YES
6 REPLACE 2499-F3/F4/F5 AS APPLICABLE (MM 24-21-00/ 24-24-04). IF FAULT PERSISTS, CHECK AND REPAIR WIRING AS NECESSARY FROM GCU K J1B-9/J24B TO 2499-F3/F4/F5 FUSE AS APPLICABLE WD 24-21-10/11/12).
1 MANUALLY RECLOSE ERATOR FIELD AND OPEN GENERATOR BREAKER. IS GENERATOR BREAKER OPEN LIGHT ON?
NO
7 REPLACE GENERATOR BREAKER TRIP SWITCHLIGHT DS4/DS10/DS16/2424-DS3 AS APPLICABLE (MM 20-33-01).
YES
2 PRESS GENERATOR BREAKER CLOSE SWITCHLIGHT. IS FLOWBAR ON?
NO
8 REPLACE GENERATOR BREAKER CLOSE SWITCHLIGHT DS3/DS9/DS15/2424-DS4 AS APPLICABLE (MM 20-33-01).
YES
3 GENERATOR BREAKER OPERATIONAL (FOR GENERATOR PARALLELING FAULT ISOLATION REF. FIG. 111).

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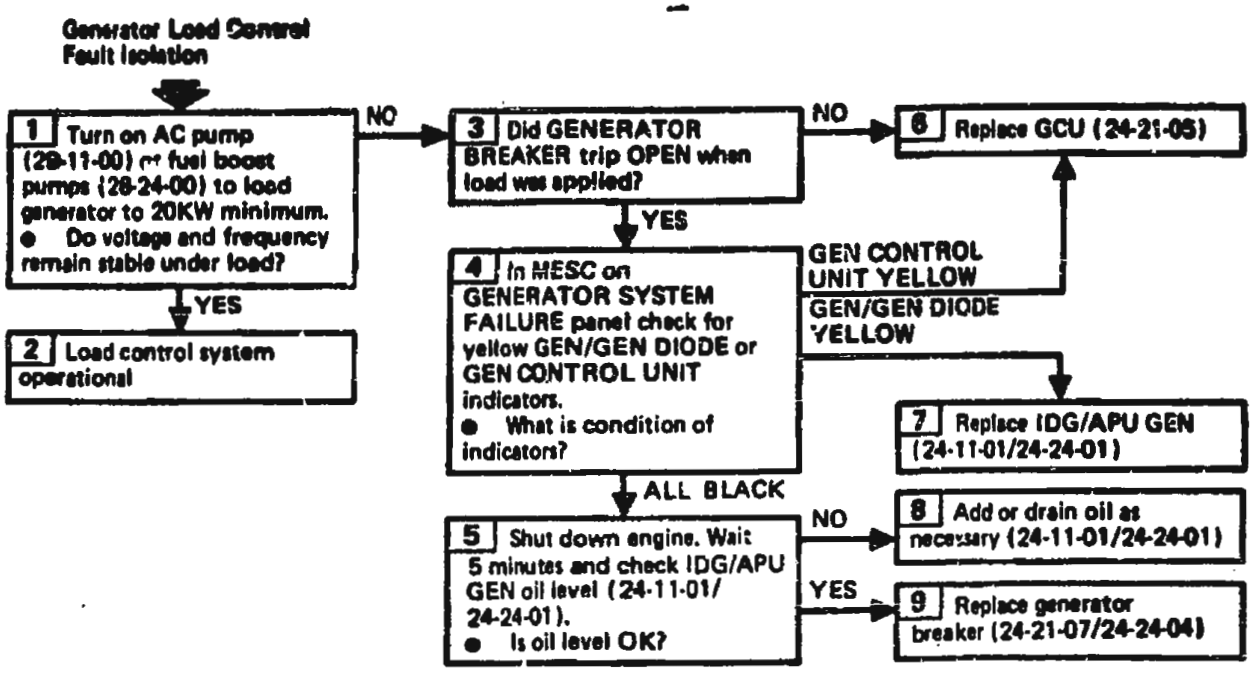
Generator Breaker Control Fault Isolation
Figure 108 (Sheet 2)


Generator Load Control Fault Isolation
1 Turn on AC pump (28-11-00) or fuel boost pumps (28-24-00) to load generator to 20KW minimum.
● Do voltage and frequency remain stable under load?
NO
YES
2 Load control system operational
3 Did GENERATOR BREAKER trip OPEN when load was applied?
NO
YES
6 Replace GCU (24-21-05)
4 In MESC on GENERATOR SYSTEM FAILURE panel check for yellow GEN/GEN DIODE or GEN CONTROL UNIT indicators.
● What is condition of indicators?
GEN CONTROL UNIT YELLOW
GEN/GEN DIODE YELLOW
7 Replace IDG/APU GEN (24-11-01/24-24-01)
ALL BLACK
5 Shut down engine. Wait 5 minutes and check IDG/APU GEN oil level (24-11-01/24-24-01).
● Is oil level OK?
NO
YES
8 Add or drain oil as necessary (24-11-01/24-24-01)
9 Replace generator breaker (24-21-07/24-24-04)

PREREQUISITES
Elec pwr (24-00-00)
Generator operating (24-21-00/24-24-00)
Generator not paralleled
CB's in: 1K15, 1K16, 1K17, 3B17, 3D10, 3D13, 3D16, 1K10, 3G16

M1-0101-24-578

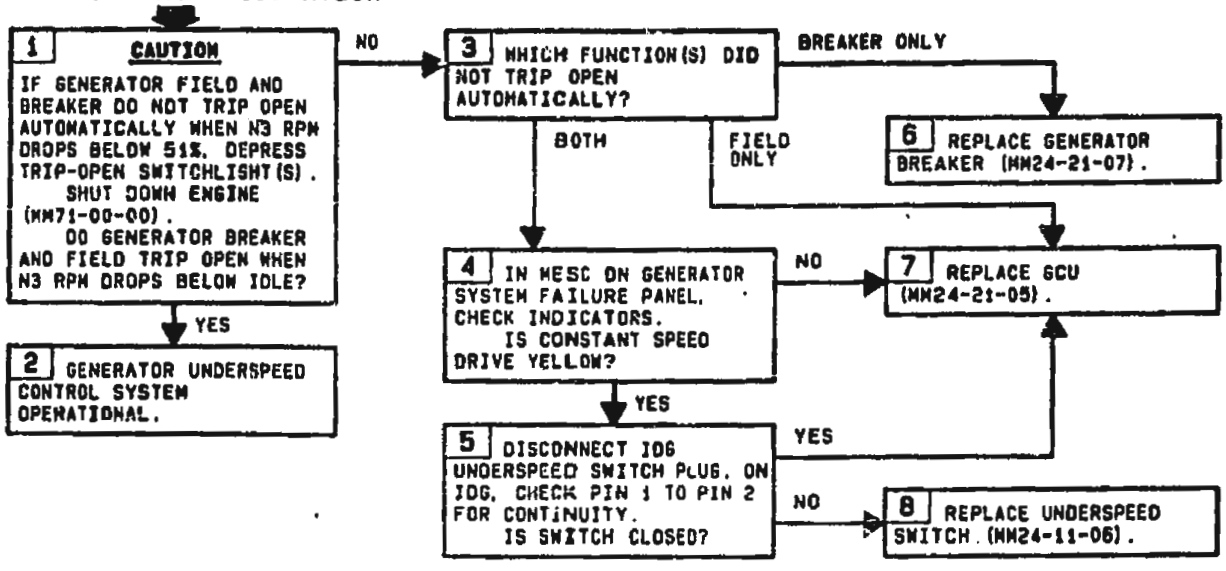
R R Generator Load Control Fault Isolation
Figure 109

EFFECTIVITY: ALL

001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
ENGINE A IDLE (MM71-00-00)
GENERATOR NOT PARALLELED
CB'S IN: 1K15, 1K16, 1K17, 3D10, 3D13, 3D16, 3B18

GENERATOR UNDERSPEED CONTROL FAULT ISOLATION


1 CAUTION
IF GENERATOR FIELD AND BREAKER DO NOT TRIP OPEN AUTOMATICALLY WHEN N3 RPM DROPS BELOW 51%, DEPRESS TRIP-OPEN SWITCHLIGHT(S).
SHUT DOWN ENGINE (MM71-00-00).
DO GENERATOR BREAKER AND FIELD TRIP OPEN WHEN N3 RPM DROPS BELOW IDLE?
NO
YES
2 GENERATOR UNDERSPEED CONTROL SYSTEM OPERATIONAL.
3 WHICH FUNCTION(S) DID NOT TRIP OPEN AUTOMATICALLY?
BREAKER ONLY
BOTH
FIELD ONLY
6 REPLACE GENERATOR BREAKER (MM24-21-07).
4 IN MESC ON GENERATOR SYSTEM FAILURE PANEL, CHECK INDICATORS.
IS CONSTANT SPEED DRIVE YELLOW?
NO
7 REPLACE GCU (MM24-21-05).
YES
5 DISCONNECT IDG UNDERSPEED SWITCH PLUG, ON IDG, CHECK PIN 1 TO PIN 2 FOR CONTINUITY.
IS SWITCH CLOSED?
YES
NO
8 REPLACE UNDERSPEED SWITCH. (MM24-11-06).

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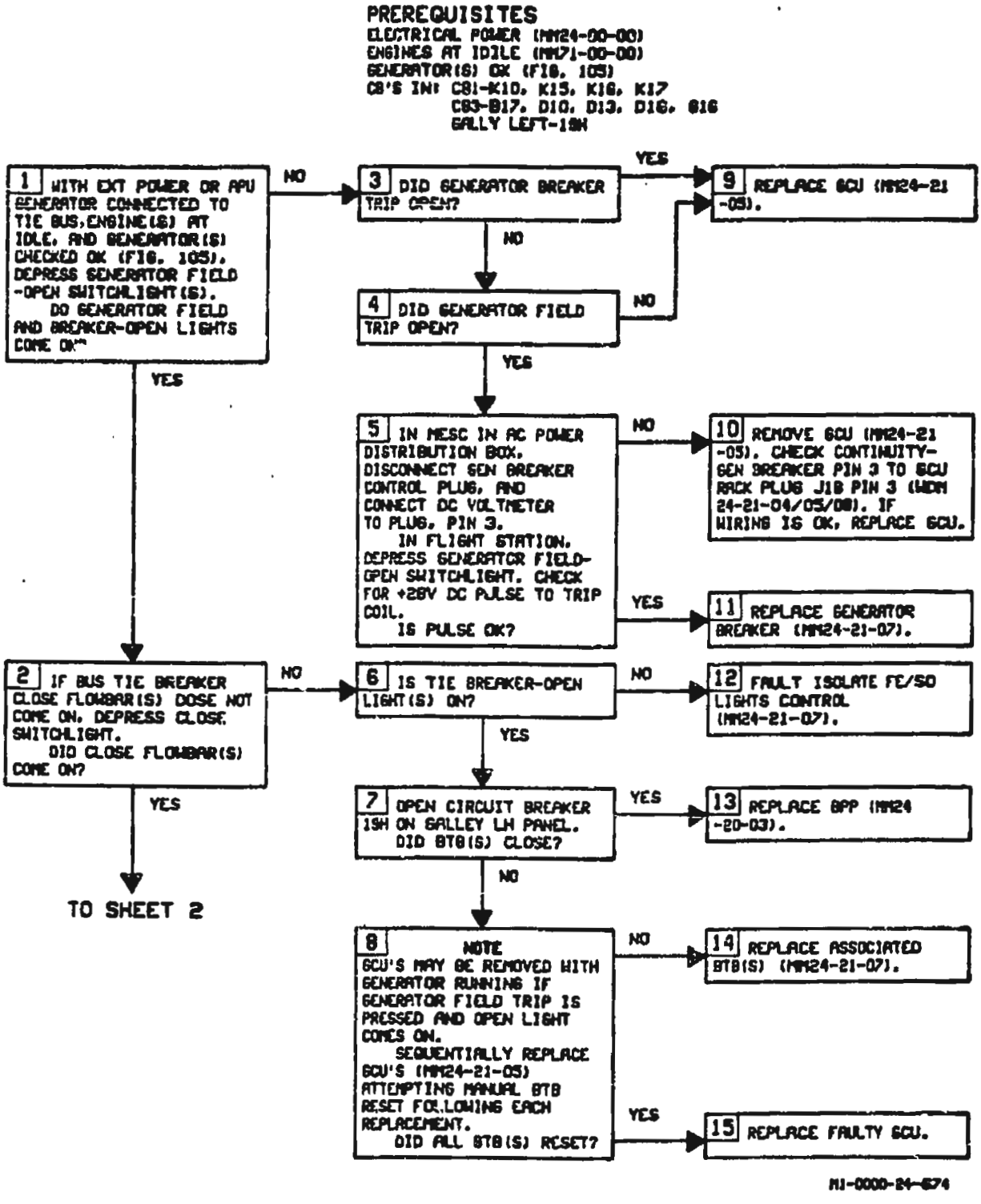
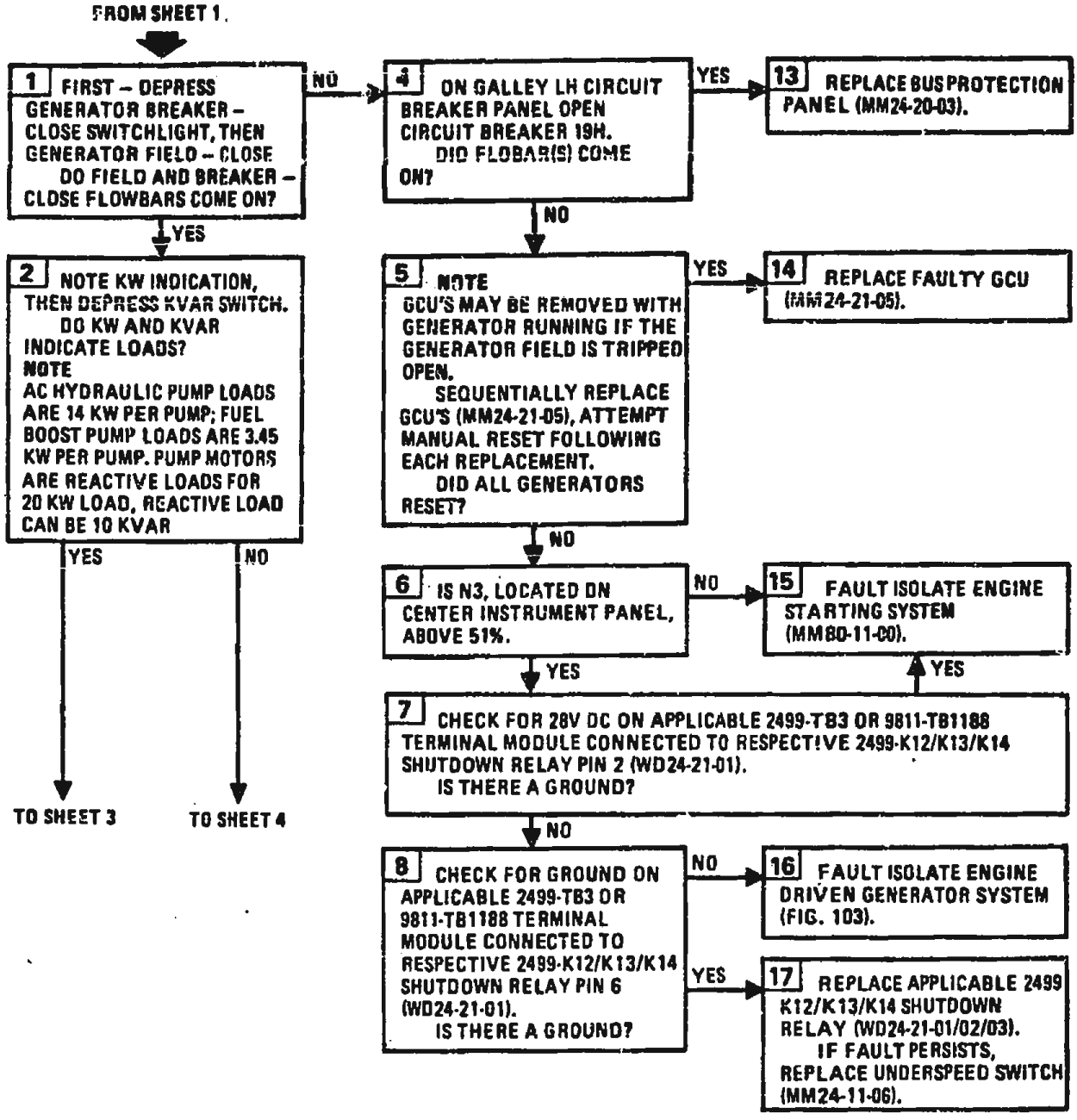
R R Generator Underspeed Control Fault Isolation
Figure 110

EFFECTIVITY: ALL

001B


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
ENGINES AT IDLE (MM71-00-00)
GENERATOR(S) OK (FIG. 105)
CB'S IN: C81-K10, K15, K16, K17
C83-B17, D10, D13, D16, B16
GALLY LEFT-1SH
1 WITH EXT POWER OR APU GENERATOR CONNECTED TO TIE BUS, ENGINE(S) AT IDLE, AND GENERATOR(S) CHECKED OK (FIG. 105), DEPRESS GENERATOR FIELD -OPEN SWITCHLIGHT(S). DO GENERATOR FIELD AND BREAKER-OPEN LIGHTS COME ON?
NO
YES
3 DID GENERATOR BREAKER TRIP OPEN?
YES
9 REPLACE GCU (MM24-21 -05).
NO
4 DID GENERATOR FIELD TRIP OPEN?
NO
YES
5 IN MESC IN AC POWER DISTRIBUTION BOX, DISCONNECT GEN BREAKER CONTROL PLUG, AND CONNECT DC VOLTMETER TO PLUG, PIN 3. IN FLIGHT STATION, DEPRESS GENERATOR FIELD-OPEN SWITCHLIGHT. CHECK FOR +28V DC PULSE TO TRIP COIL. IS PULSE OK?
NO
10 REMOVE GCU (MM24-21 -05). CHECK CONTINUITY-GEN BREAKER PIN 3 TO GCU RACK PLUG J1B PIN 3 (WDM 24-21-04/05/08). IF WIRING IS OK, REPLACE GCU.
YES
11 REPLACE GENERATOR BREAKER (MM24-21-07).
2 IF BUS TIE BREAKER CLOSE FLOWBAR(S) DOSE NOT COME ON, DEPRESS CLOSE SWITCHLIGHT. DID CLOSE FLOWBAR(S) COME ON?
NO
6 IS TIE BREAKER-OPEN LIGHT(S) ON?
NO
12 FAULT ISOLATE FE/SO LIGHTS CONTROL (MM24-21-07).
YES
YES
7 OPEN CIRCUIT BREAKER 1SH ON GALLEY LH PANEL. DID BTB(S) CLOSE?
YES
13 REPLACE BPP (MM24 -20-03).
NO
TO SHEET 2
8 NOTE GCU'S MAY BE REMOVED WITH GENERATOR RUNNING IF GENERATOR FIELD TRIP IS PRESSED AND OPEN LIGHT COMES ON. SEQUENTIALLY REPLACE GCU'S (MM24-21-05) ATTEMPTING MANUAL BTB RESET FOLLOWING EACH REPLACEMENT. DID ALL BTB(S) RESET?
NO
14 REPLACE ASSOCIATED BTB(S) (MM24-21-07).
YES
15 REPLACE FAULTY GCU.
M1-0000-24-6274

R Engine Driven Generator Paralleling Fault Isolation (Engine Running)
R Figure 111 (Sheet 1)


FROM SHEET 1.
1 FIRST – DEPRESS GENERATOR BREAKER – CLOSE SWITCHLIGHT, THEN GENERATOR FIELD – CLOSE DO FIELD AND BREAKER – CLOSE FLOWBARS COME ON?
NO
4 ON GALLEY LH CIRCUIT BREAKER PANEL OPEN CIRCUIT BREAKER 19H. DID FLOBAR(S) COME ON?
YES
13 REPLACE BUS PROTECTION PANEL (MM24-20-03).
NO
YES
2 NOTE KW INDICATION, THEN DEPRESS KVAR SWITCH. DO KW AND KVAR INDICATE LOADS?
NOTE
AC HYDRAULIC PUMP LOADS ARE 14 KW PER PUMP; FUEL BOOST PUMP LOADS ARE 3.45 KW PER PUMP. PUMP MOTORS ARE REACTIVE LOADS FOR 20 KW LOAD, REACTIVE LOAD CAN BE 10 KVAR
5 NOTE
GCU'S MAY BE REMOVED WITH GENERATOR RUNNING IF THE GENERATOR FIELD IS TRIPPED OPEN.
SEQUENTIALLY REPLACE GCU'S (MM24-21-05), ATTEMPT MANUAL RESET FOLLOWING EACH REPLACEMENT.
DID ALL GENERATORS RESET?
YES
14 REPLACE FAULTY GCU (MM24-21-05).
YES
NO
NO
6 IS N3, LOCATED ON CENTER INSTRUMENT PANEL, ABOVE 51%.
NO
15 FAULT ISOLATE ENGINE STARTING SYSTEM (MM80-11-00).
YES
YES
7 CHECK FOR 28V DC ON APPLICABLE 2499-TB3 OR 9811-TB1188 TERMINAL MODULE CONNECTED TO RESPECTIVE 2499-K12/K13/K14 SHUTDOWN RELAY PIN 2 (WD24-21-01). IS THERE A GROUND?
NO
8 CHECK FOR GROUND ON APPLICABLE 2499-TB3 OR 9811-TB1188 TERMINAL MODULE CONNECTED TO RESPECTIVE 2499-K12/K13/K14 SHUTDOWN RELAY PIN 6 (WD24-21-01). IS THERE A GROUND?
NO
16 FAULT ISOLATE ENGINE DRIVEN GENERATOR SYSTEM (FIG. 103).
YES
17 REPLACE APPLICABLE 2499 K12/K13/K14 SHUTDOWN RELAY (WD24-21-01/02/03). IF FAULT PERSISTS, REPLACE UNDERSPEED SWITCH (MM24-11-06).
TO SHEET 3
TO SHEET 4

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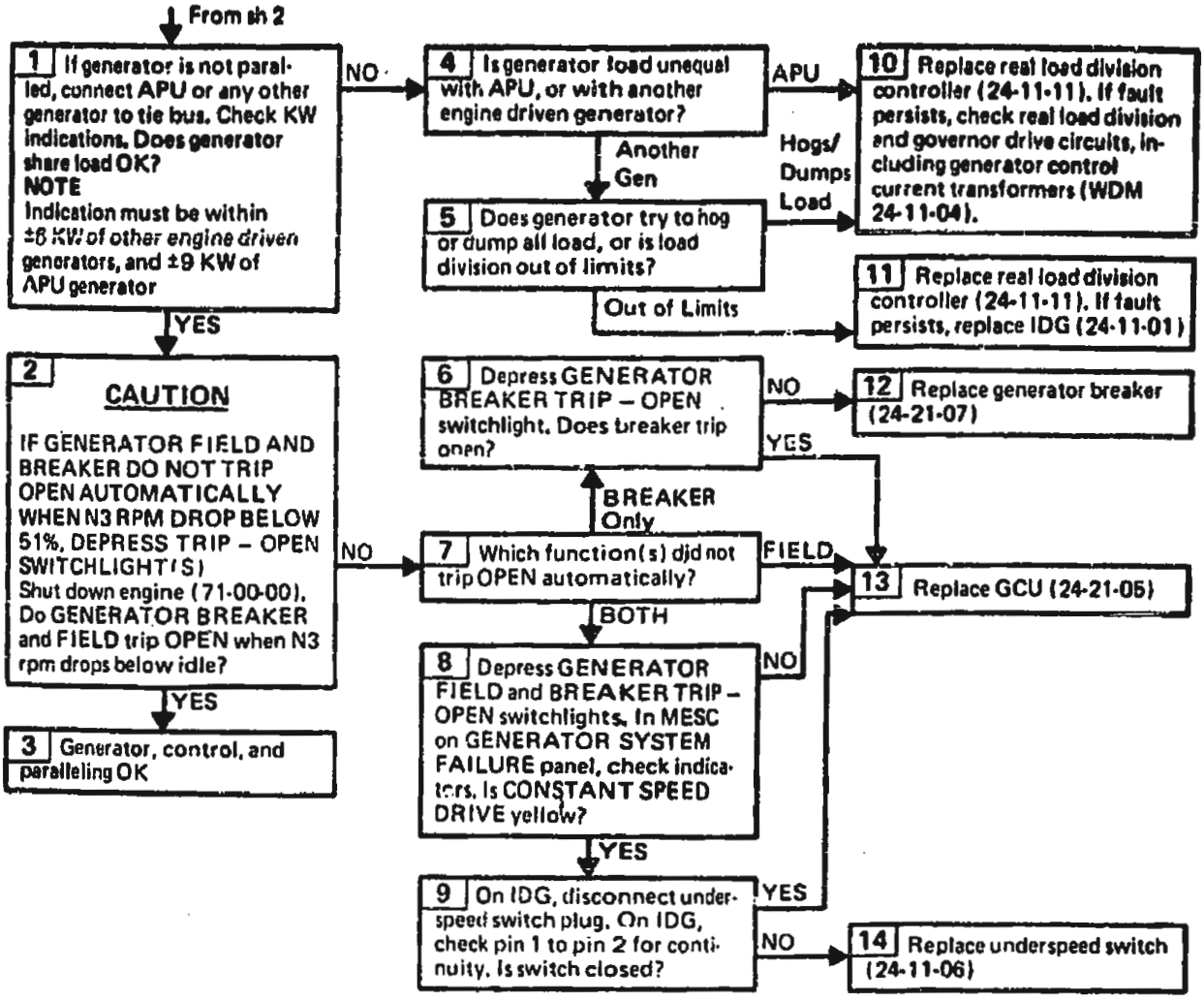
R Engine Driven Generator Paralleling Fault Isolation (Engine Running)
R Figure 111 (Sheet 2)


From sh 2
1 If generator is not paralled, connect APU or any other generator to tie bus. Check KW indications. Does generator share load OK?
NOTE
Indication must be within ±6 KW of other engine driven generators, and ±9 KW of APU generator
NO
YES
2
CAUTION
IF GENERATOR FIELD AND BREAKER DO NOT TRIP OPEN AUTOMATICALLY WHEN N3 RPM DROP BELOW 51%, DEPRESS TRIP – OPEN SWITCHLIGHT(S)
Shut down engine (71-00-00). Do GENERATOR BREAKER and FIELD trip OPEN when N3 rpm drops below idle?
NO
YES
3 Generator, control, and paralleling OK
4 Is generator load unequal with APU, or with another engine driven generator?
APU
Another Gen
Hogs/ Dumps Load
10 Replace real load division controller (24-11-11). If fault persists, check real load division and governor drive circuits, including generator control current transformers (WDM 24-11-04).
5 Does generator try to hog or dump all load, or is load division out of limits?
Out of Limits
11 Replace real load division controller (24-11-11). If fault persists, replace IDG (24-11-01)
6 Depress GENERATOR BREAKER TRIP – OPEN switchlight. Does breaker trip open?
NO
12 Replace generator breaker (24-21-07)
YES
BREAKER Only
7 Which function(s) did not trip OPEN automatically?
FIELD
BOTH
13 Replace GCU (24-21-05)
8 Depress GENERATOR FIELD and BREAKER TRIP – OPEN switchlights. In MESC on GENERATOR SYSTEM FAILURE panel, check indicators. Is CONSTANT SPEED DRIVE yellow?
NO
YES
9 On IDG, disconnect underspeed switch plug. On IDG, check pin 1 to pin 2 for continuity. Is switch closed?
YES
NO
14 Replace underspeed switch (24-11-06)

ABBREVIATIONS

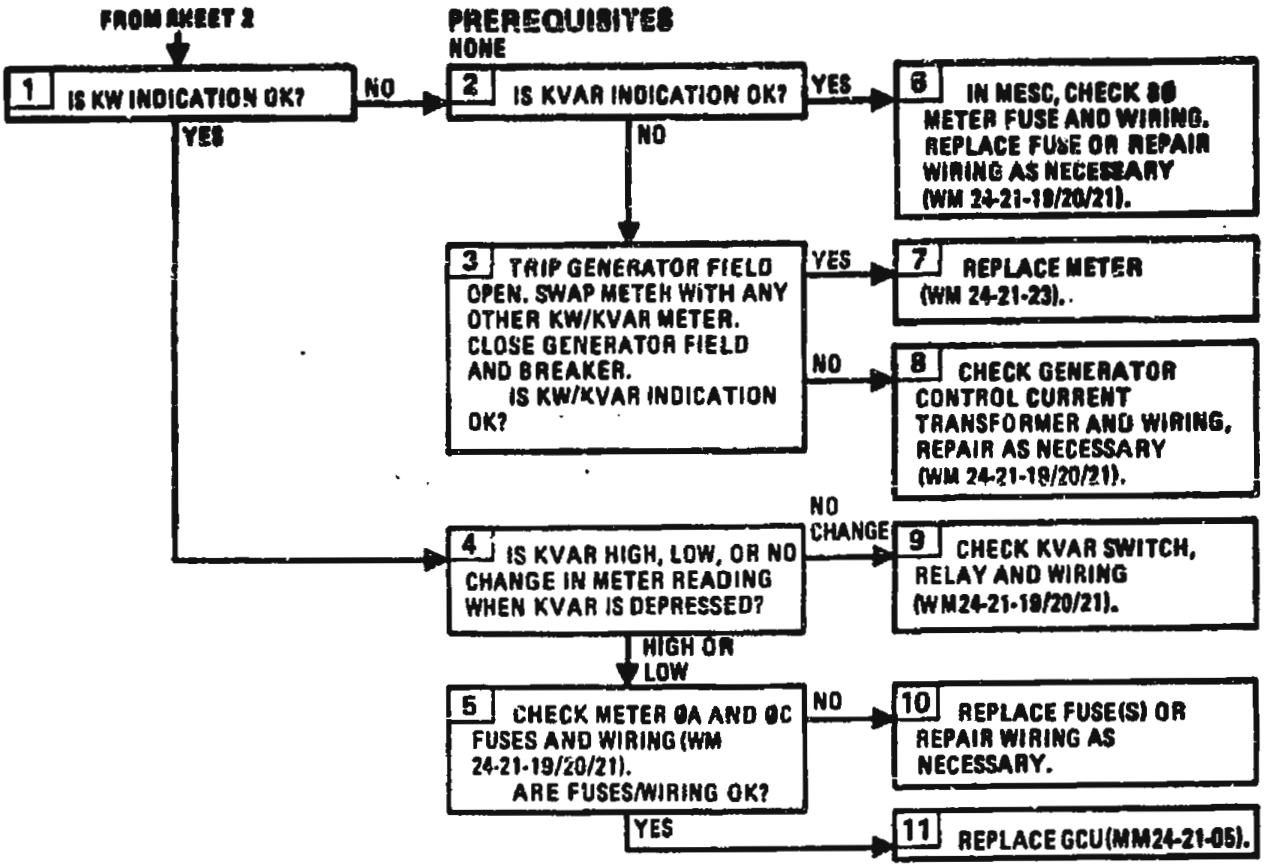
BPP	Bus protection panel
GCU	Generator control unit
IDG	Integrated drive generator
ILCB	Indicator lights control box
MESC	Mid electrical service center
N3	Engine high pressure section

M1-0001-24-5016

R Engine Driven Generator Parralleling Fault Isolation (Engine
R Running)
R Figure 111 (Sheet 3)

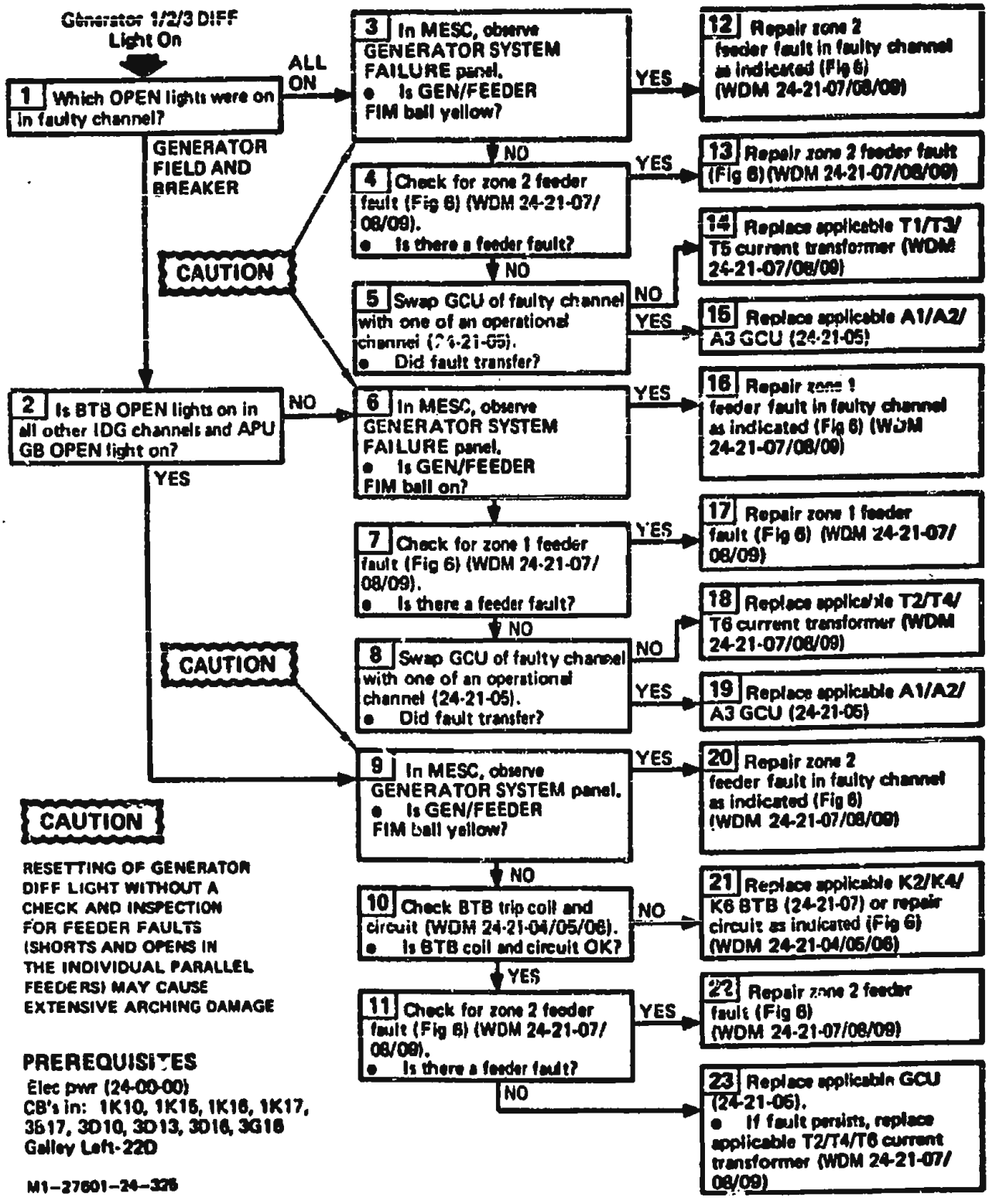
EFFECTIVITY: ALL

001B


FROM SHEET 2
PREREQUISITES
NONE
1 IS KW INDICATION OK?
NO
YES
2 IS KVAR INDICATION OK?
YES
NO
6 IN MESC, CHECK 8G METER FUSE AND WIRING. REPLACE FUSE OR REPAIR WIRING AS NECESSARY (WM 24-21-19/20/21).
3 TRIP GENERATOR FIELD OPEN. SWAP METER WITH ANY OTHER KW/KVAR METER. CLOSE GENERATOR FIELD AND BREAKER. IS KW/KVAR INDICATION OK?
YES
7 REPLACE METER (WM 24-21-23).
NO
8 CHECK GENERATOR CONTROL CURRENT TRANSFORMER AND WIRING, REPAIR AS NECESSARY (WM 24-21-19/20/21).
4 IS KVAR HIGH, LOW, OR NO CHANGE IN METER READING WHEN KVAR IS DEPRESSED?
NO CHANGE
9 CHECK KVAR SWITCH, RELAY AND WIRING (WM24-21-19/20/21).
HIGH OR LOW
5 CHECK METER 0A AND 0C FUSES AND WIRING (WM 24-21-19/20/21). ARE FUSES/WIRING OK?
NO
10 REPLACE FUSE(S) OR REPAIR WIRING AS NECESSARY.
YES
11 REPLACE GCU(MM24-21-05).

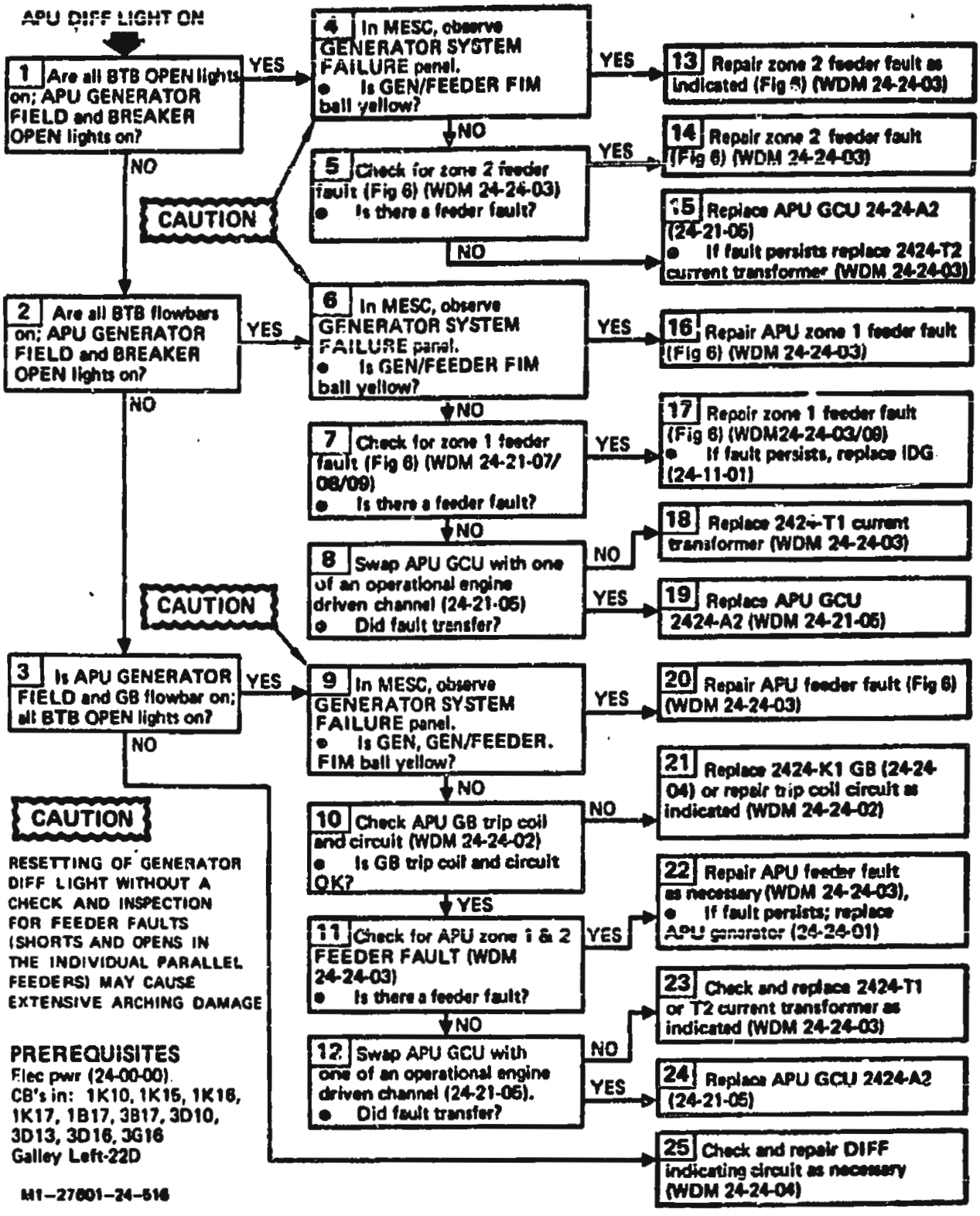
M1-0000-24-056

Engine Driven Generator Paralleling Fault Isolation (Engine Running)
Figure 111 (Sheet 4)


Generator 1/2/3 DIFF Light On
1 Which OPEN lights were on in faulty channel?
ALL ON
GENERATOR FIELD AND BREAKER
CAUTION
2 Is BTB OPEN lights on in all other IDG channels and APU GB OPEN light on?
NO
YES
3 In MESC, observe GENERATOR SYSTEM FAILURE panel.
• Is GEN/FEEDER FIM ball yellow?
YES
12 Repair zone 2 feeder fault in faulty channel as indicated (Fig 6) (WDM 24-21-07/08/09)
NO
4 Check for zone 2 feeder fault (Fig 6) (WDM 24-21-07/08/09).
• Is there a feeder fault?
YES
13 Repair zone 2 feeder fault (Fig 6) (WDM 24-21-07/08/09)
NO
5 Swap GCU of faulty channel with one of an operational channel (24-21-05).
• Did fault transfer?
NO
14 Replace applicable T1/T3/T5 current transformer (WDM 24-21-07/08/09)
YES
15 Replace applicable A1/A2/A3 GCU (24-21-05)
6 In MESC, observe GENERATOR SYSTEM FAILURE panel.
• Is GEN/FEEDER FIM ball on?
YES
16 Repair zone 1 feeder fault in faulty channel as indicated (Fig 6) (WDM 24-21-07/08/09)
7 Check for zone 1 feeder fault (Fig 6) (WDM 24-21-07/08/09).
• Is there a feeder fault?
YES
17 Repair zone 1 feeder fault (Fig 6) (WDM 24-21-07/08/09)
NO
8 Swap GCU of faulty channel with one of an operational channel (24-21-05).
• Did fault transfer?
NO
18 Replace applicable T2/T4/T6 current transformer (WDM 24-21-07/08/09)
YES
19 Replace applicable A1/A2/A3 GCU (24-21-05)
CAUTION
9 In MESC, observe GENERATOR SYSTEM panel.
• Is GEN/FEEDER FIM ball yellow?
YES
20 Repair zone 2 feeder fault in faulty channel as indicated (Fig 6) (WDM 24-21-07/08/09)
NO
10 Check BTB trip coil and circuit (WDM 24-21-04/05/06).
• Is BTB coil and circuit OK?
NO
21 Replace applicable K2/K4/K6 BTB (24-21-07) or repair circuit as indicated (Fig 6) (WDM 24-21-04/05/06)
YES
11 Check for zone 2 feeder fault (Fig 6) (WDM 24-21-07/08/09).
• Is there a feeder fault?
YES
22 Repair zone 2 feeder fault (Fig 6) (WDM 24-21-07/08/09)
NO
23 Replace applicable GCU (24-21-05).
• If fault persists, replace applicable T2/T4/T6 current transformer (WDM 24-21-07/08/09)
CAUTION
RESETTING OF GENERATOR DIFF LIGHT WITHOUT A CHECK AND INSPECTION FOR FEEDER FAULTS (SHORTS AND OPENS IN THE INDIVIDUAL PARALLEL FEEDERS) MAY CAUSE EXTENSIVE ARCHING DAMAGE
PREREQUISITES
Elec pwr (24-00-00)
CB's in: 1K10, 1K15, 1K16, 1K17, 3B17, 3D10, 3D13, 3D16, 3G18
Galley Left-22D
M1-27601-24-326

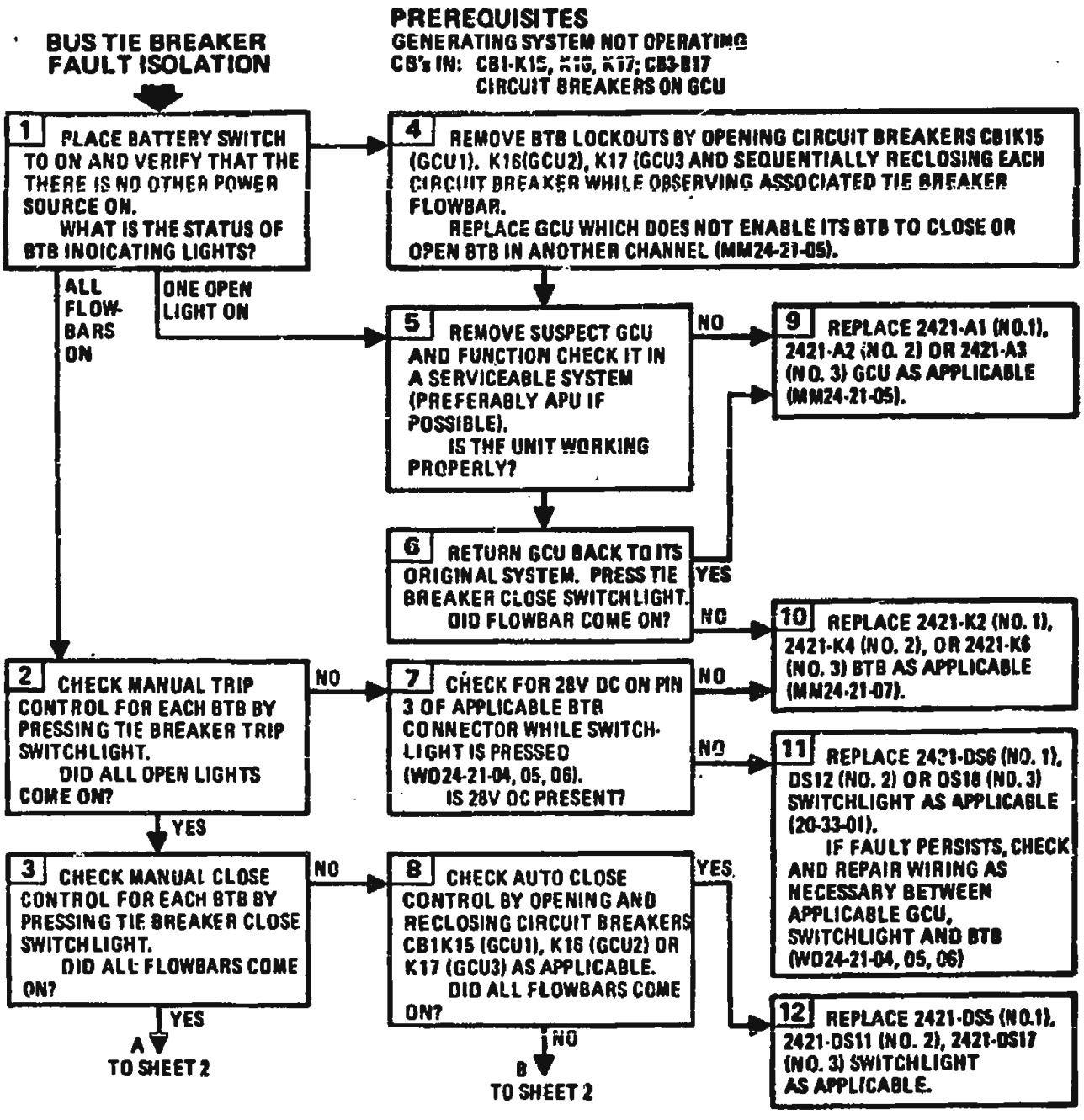
R Engine Driven Generator DIFF Light On Fault Isolation
R Figure 112A

R EFFECTIVITY: ALL


APU DIFF LIGHT ON
1 Are all BTB OPEN lights on; APU GENERATOR FIELD and BREAKER OPEN lights on?
YES
NO
2 Are all BTB flowbars on; APU GENERATOR FIELD and BREAKER OPEN lights on?
YES
NO
3 Is APU GENERATOR FIELD and GB flowbar on; all BTB OPEN lights on?
YES
NO
CAUTION
RESETTING OF GENERATOR DIFF LIGHT WITHOUT A CHECK AND INSPECTION FOR FEEDER FAULTS (SHORTS AND OPENS IN THE INDIVIDUAL PARALLEL FEEDERS) MAY CAUSE EXTENSIVE ARCHING DAMAGE
PREREQUISITES
Elec pwr (24-00-00).
CB's in: 1K10, 1K15, 1K16, 1K17, 1B17, 3B17, 3D10, 3D13, 3D16, 3G16
Galley Left-22D
M1-27601-24-516
4 In MESC, observe GENERATOR SYSTEM FAILURE panel.
• Is GEN/FEEDER FIM ball yellow?
YES
NO
5 Check for zone 2 feeder fault (Fig 6) (WDM 24-24-03)
• Is there a feeder fault?
YES
NO
CAUTION
6 In MESC, observe GENERATOR SYSTEM FAILURE panel.
• Is GEN/FEEDER FIM ball yellow?
YES
NO
7 Check for zone 1 feeder fault (Fig 6) (WDM 24-21-07/08/09)
• Is there a feeder fault?
YES
NO
8 Swap APU GCU with one of an operational engine driven channel (24-21-05)
• Did fault transfer?
NO
YES
CAUTION
9 In MESC, observe GENERATOR SYSTEM FAILURE panel.
• Is GEN, GEN/FEEDER. FIM ball yellow?
YES
NO
10 Check APU GB trip coil and circuit (WDM 24-24-02)
• Is GB trip coil and circuit OK?
NO
YES
11 Check for APU zone 1 & 2 FEEDER FAULT (WDM 24-24-03)
• Is there a feeder fault?
YES
NO
12 Swap APU GCU with one of an operational engine driven channel (24-21-05).
• Did fault transfer?
NO
YES
13 Repair zone 2 feeder fault as indicated (Fig 6) (WDM 24-24-03)
14 Repair zone 2 feeder fault (Fig 6) (WDM 24-24-03)
15 Replace APU GCU 24-24-A2 (24-21-05)
• If fault persists replace 2424-T2 current transformer (WDM 24-24-03)
16 Repair APU zone 1 feeder fault (Fig 6) (WDM 24-24-03)
17 Repair zone 1 feeder fault (Fig 6) (WDM24-24-03/09)
• If fault persists, replace IDG (24-11-01)
18 Replace 2424-T1 current transformer (WDM 24-24-03)
19 Replace APU GCU 2424-A2 (WDM 24-21-05)
20 Repair APU feeder fault (Fig 6) (WDM 24-24-03)
21 Replace 2424-K1 GB (24-24-04) or repair trip coil circuit as indicated (WDM 24-24-02)
22 Repair APU feeder fault as necessary (WDM 24-24-03),
• If fault persists; replace APU generator (24-24-01)
23 Check and replace 2424-T1 or T2 current transformer as indicated (WDM 24-24-03)
24 Replace APU GCU 2424-A2 (24-21-05)
25 Check and repair DIFF indicating circuit as necessary (WDM 24-24-04)

R R APU DIFF Light On Fault Isolation
Figure 112B

R EFFECTIVITY: ALL
R R
0018

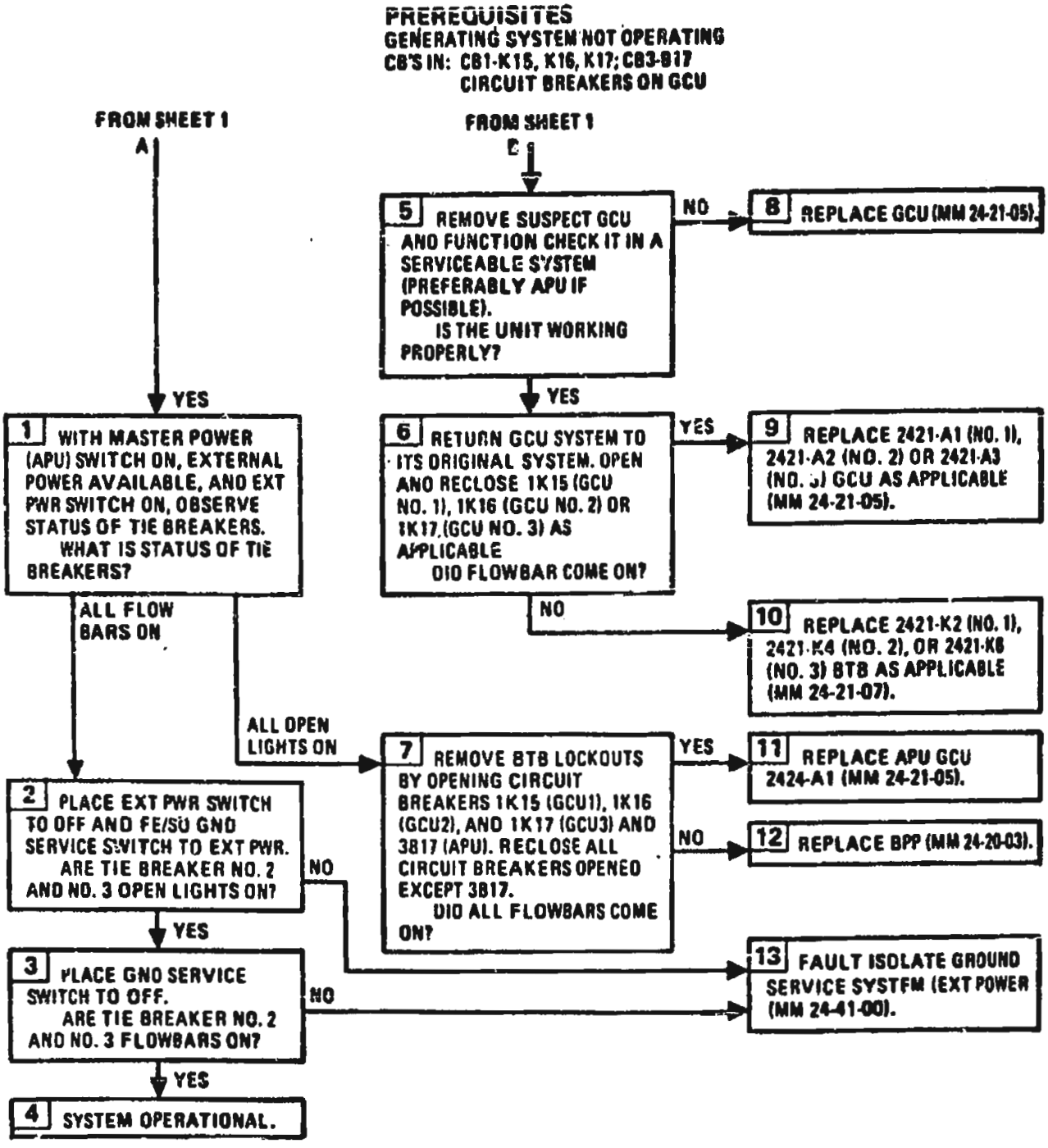

BUS TIE BREAKER FAULT ISOLATION
PREREQUISITES
GENERATING SYSTEM NOT OPERATING
CB's IN: CB1-K15, K16, K17; CB3-B17
CIRCUIT BREAKERS ON GCU
1 PLACE BATTERY SWITCH TO ON AND VERIFY THAT THE THERE IS NO OTHER POWER SOURCE ON.
WHAT IS THE STATUS OF BTB INDICATING LIGHTS?
ALL FLOW-BARS ON
ONE OPEN LIGHT ON
4 REMOVE BTB LOCKOUTS BY OPENING CIRCUIT BREAKERS CB1K15 (GCU1), K16(GCU2), K17 (GCU3 AND SEQUENTIALLY RECLOSING EACH CIRCUIT BREAKER WHILE OBSERVING ASSOCIATED TIE BREAKER FLOWBAR.
REPLACE GCU WHICH DOES NOT ENABLE ITS BTB TO CLOSE OR OPEN BTB IN ANOTHER CHANNEL (MM24-21-05).
5 REMOVE SUSPECT GCU AND FUNCTION CHECK IT IN A SERVICEABLE SYSTEM (PREFERABLY APU IF POSSIBLE).
IS THE UNIT WORKING PROPERLY?
NO
9 REPLACE 2421-A1 (NO.1), 2421-A2 (NO. 2) OR 2421-A3 (NO. 3) GCU AS APPLICABLE (MM24-21-05).
6 RETURN GCU BACK TO ITS ORIGINAL SYSTEM. PRESS TIE BREAKER CLOSE SWITCHLIGHT.
DID FLOWBAR COME ON?
YES
NO
10 REPLACE 2421-K2 (NO. 1), 2421-K4 (NO. 2), OR 2421-K6 (NO. 3) BTB AS APPLICABLE (MM24-21-07).
2 CHECK MANUAL TRIP CONTROL FOR EACH BTB BY PRESSING TIE BREAKER TRIP SWITCHLIGHT.
DID ALL OPEN LIGHTS COME ON?
NO
7 CHECK FOR 28V DC ON PIN 3 OF APPLICABLE BTB CONNECTOR WHILE SWITCHLIGHT IS PRESSED (WD24-21-04, 05, 06).
IS 28V DC PRESENT?
NO
11 REPLACE 2421-DS6 (NO. 1), DS12 (NO. 2) OR DS18 (NO. 3) SWITCHLIGHT AS APPLICABLE (20-33-01).
IF FAULT PERSISTS, CHECK AND REPAIR WIRING AS NECESSARY BETWEEN APPLICABLE GCU, SWITCHLIGHT AND BTB (WD24-21-04, 05, 06)
YES
3 CHECK MANUAL CLOSE CONTROL FOR EACH BTB BY PRESSING TIE BREAKER CLOSE SWITCHLIGHT.
DID ALL FLOWBARS COME ON?
NO
8 CHECK AUTO CLOSE CONTROL BY OPENING AND RECLOSING CIRCUIT BREAKERS CB1K15 (GCU1), K16 (GCU2) OR K17 (GCU3) AS APPLICABLE.
DID ALL FLOWBARS COME ON?
YES
12 REPLACE 2421-DS5 (NO.1), 2421-DS11 (NO. 2), 2421-DS17 (NO. 3) SWITCHLIGHT AS APPLICABLE.
YES
A
TO SHEET 2
NO
B
TO SHEET 2

NOTE
AT NO TIME FIT A SERVICEABLE UNIT FROM ANOTHER SYSTEM TO THE SUSPECT SYSTEM.

M1-0001-24-383

R R Bus Tie Breaker Control Fault Isolation
Figure 113 (Sheet 1)

R EFFECTIVITY: ALL
R R
001B

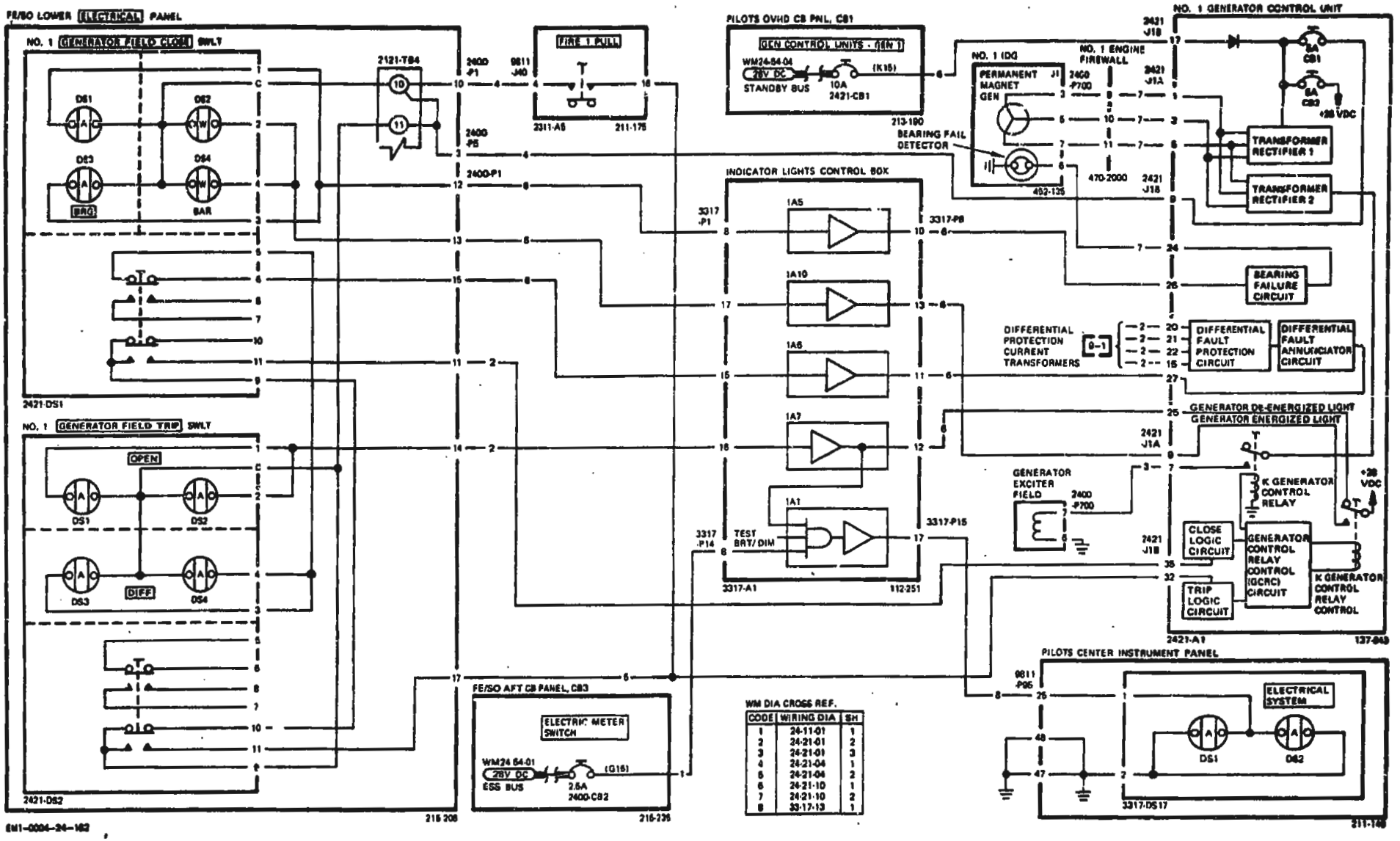

PREREQUISITES
GENERATING SYSTEM NOT OPERATING
CB'S IN: CB1-K15, K16, K17; CB3-B17
CIRCUIT BREAKERS ON GCU
FROM SHEET 1
A
FROM SHEET 1
B
5 REMOVE SUSPECT GCU AND FUNCTION CHECK IT IN A SERVICEABLE SYSTEM (PREFERABLY APU IF POSSIBLE). IS THE UNIT WORKING PROPERLY?
NO
8 REPLACE GCU (MM 24-21-05).
YES
1 WITH MASTER POWER (APU) SWITCH ON, EXTERNAL POWER AVAILABLE, AND EXT PWR SWITCH ON, OBSERVE STATUS OF TIE BREAKERS. WHAT IS STATUS OF TIE BREAKERS?
6 RETURN GCU SYSTEM TO ITS ORIGINAL SYSTEM. OPEN AND RECLOSE 1K15 (GCU NO. 1), 1K16 (GCU NO. 2) OR 1K17 (GCU NO. 3) AS APPLICABLE DID FLOWBAR COME ON?
YES
9 REPLACE 2421-A1 (NO. 1), 2421-A2 (NO. 2) OR 2421-A3 (NO. 3) GCU AS APPLICABLE (MM 24-21-05).
NO
10 REPLACE 2421-K2 (NO. 1), 2421-K4 (NO. 2), OR 2421-K6 (NO. 3) BTB AS APPLICABLE (MM 24-21-07).
ALL FLOW BARS ON
ALL OPEN LIGHTS ON
7 REMOVE BTB LOCKOUTS BY OPENING CIRCUIT BREAKERS 1K15 (GCU1), 1K16 (GCU2), AND 1K17 (GCU3) AND 3817 (APU). RECLOSE ALL CIRCUIT BREAKERS OPENED EXCEPT 3817. DID ALL FLOWBARS COME ON?
YES
11 REPLACE APU GCU 2424-A1 (MM 24-21-05).
NO
12 REPLACE BPP (MM 24-20-03).
2 PLACE EXT PWR SWITCH TO OFF AND FE/SU GND SERVICE SWITCH TO EXT PWR. ARE TIE BREAKER NO. 2 AND NO. 3 OPEN LIGHTS ON?
NO
YES
3 PLACE GND SERVICE SWITCH TO OFF. ARE TIE BREAKER NO. 2 AND NO. 3 FLOWBARS ON?
NO
YES
4 SYSTEM OPERATIONAL.
13 FAULT ISOLATE GROUND SERVICE SYSTEM (EXT POWER (MM 24-41-00).

NOTE
AT NO TIME FIT A SERVICEABLE UNIT FROM ANOTHER SYSTEM TO SUSPECT SYSTEM

M1-0002-24-170

R R Bus Tie Breaker Control Fault Isolation
Figure 113 (Sheet 2)

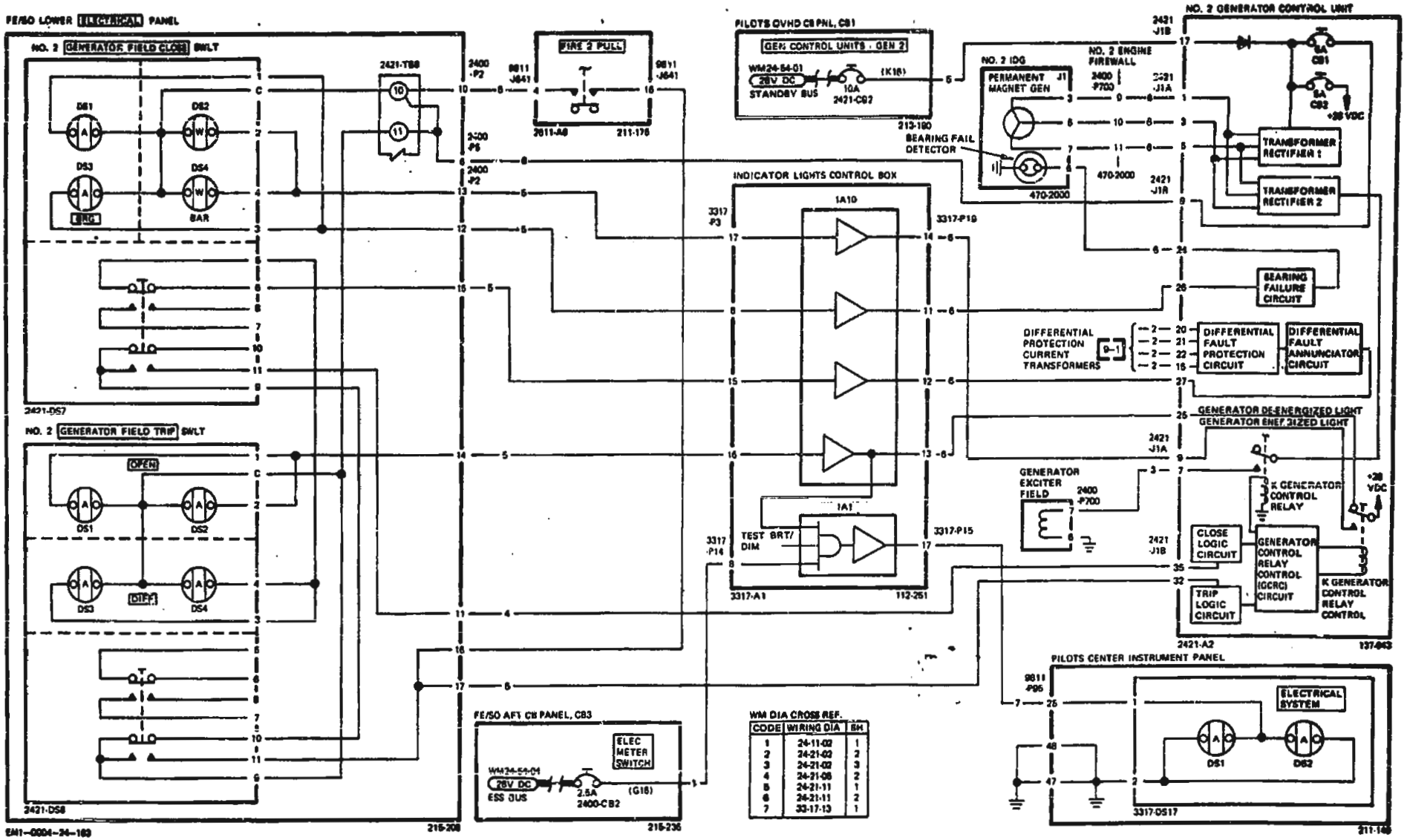
R R 001B EFFECTIVITY: ALL



R Generator Field Control and Indication Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: ALL

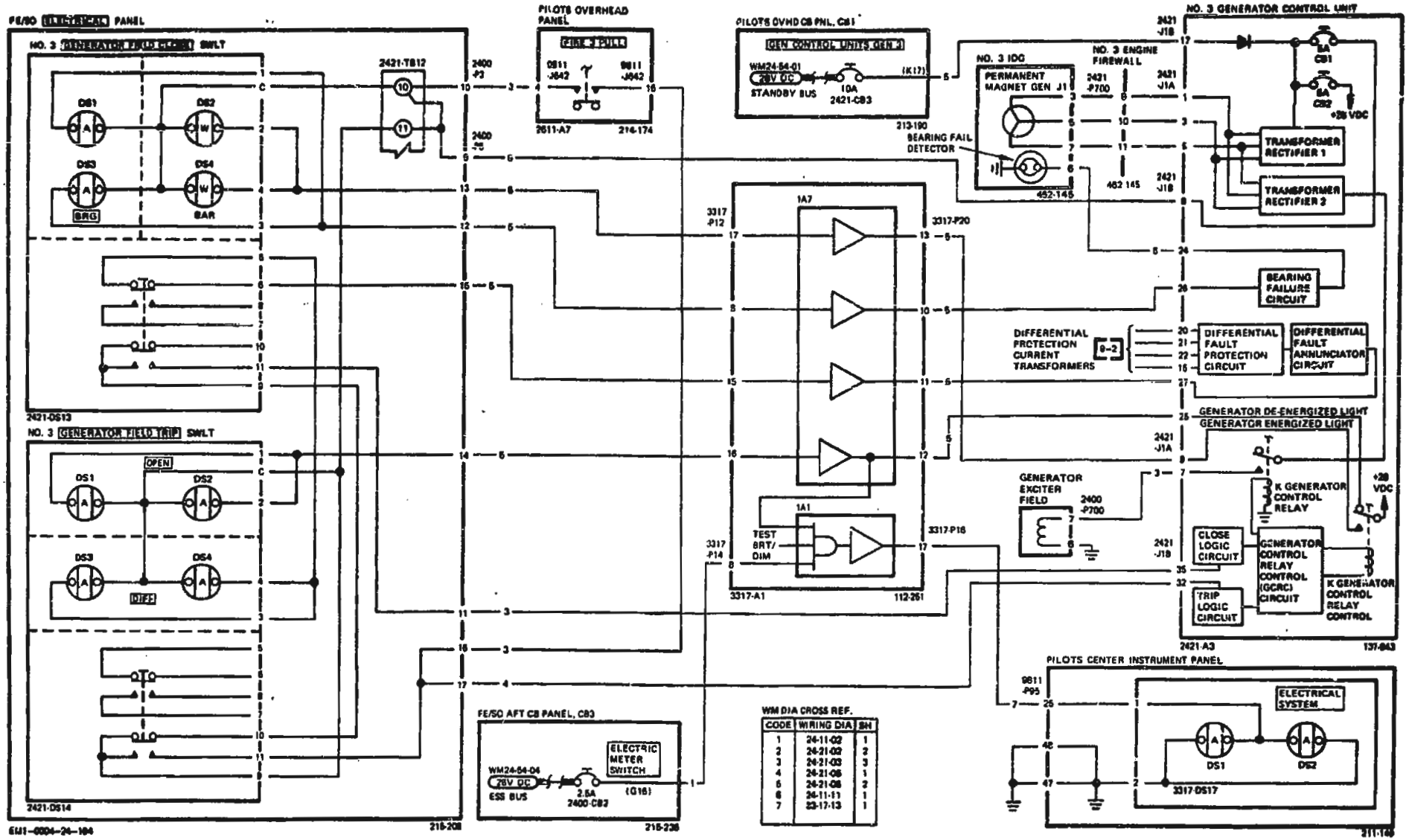
001B



R Generator Field Control and Indication Schematic
R SCHEM 1 (Sheet 2)

EFFECTIVITY: ALL

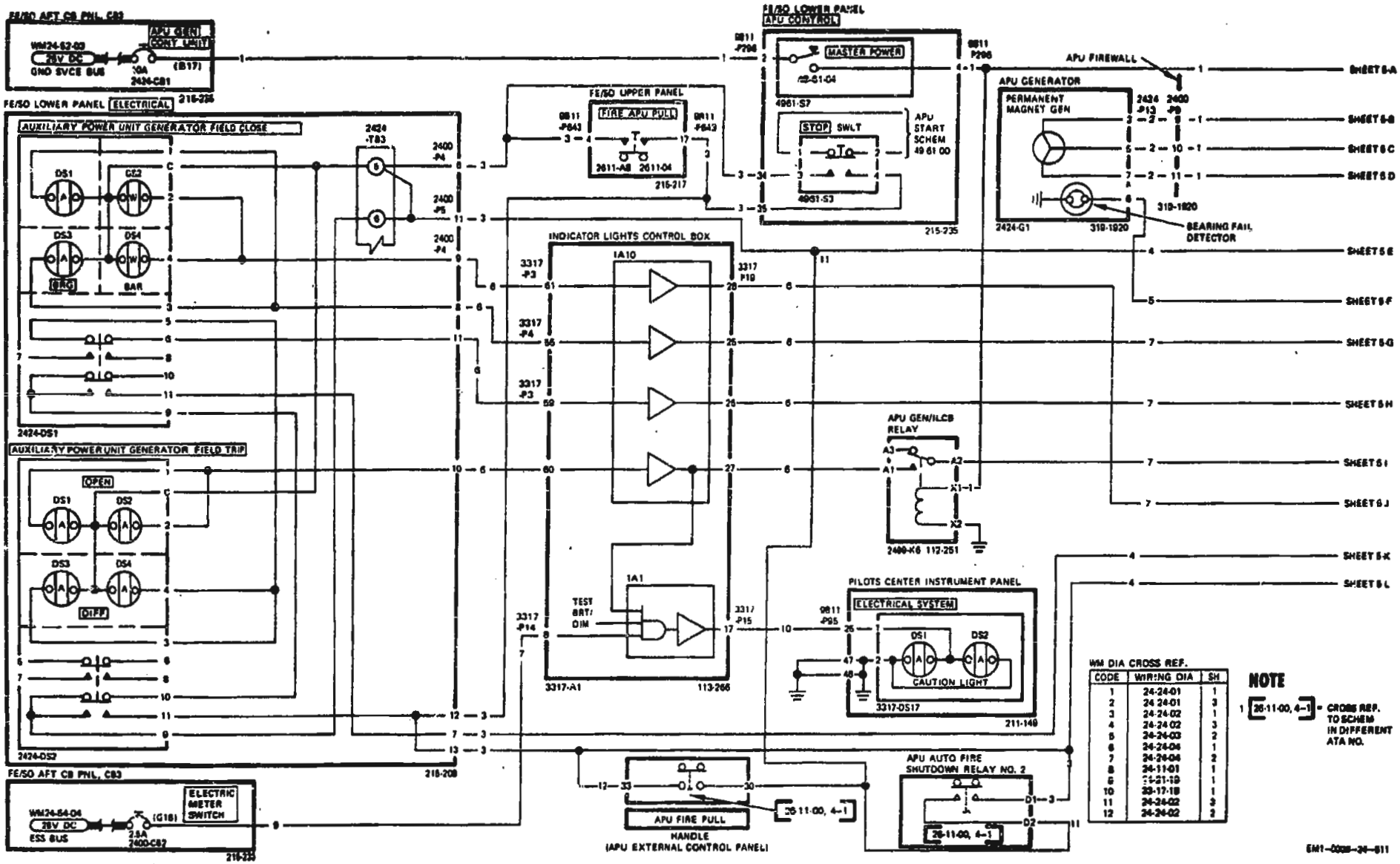
0018



R Generator Field Control and Indication Schematic
R SCHEM 1 (Sheet 3)

EFFECTIVITY: ALL

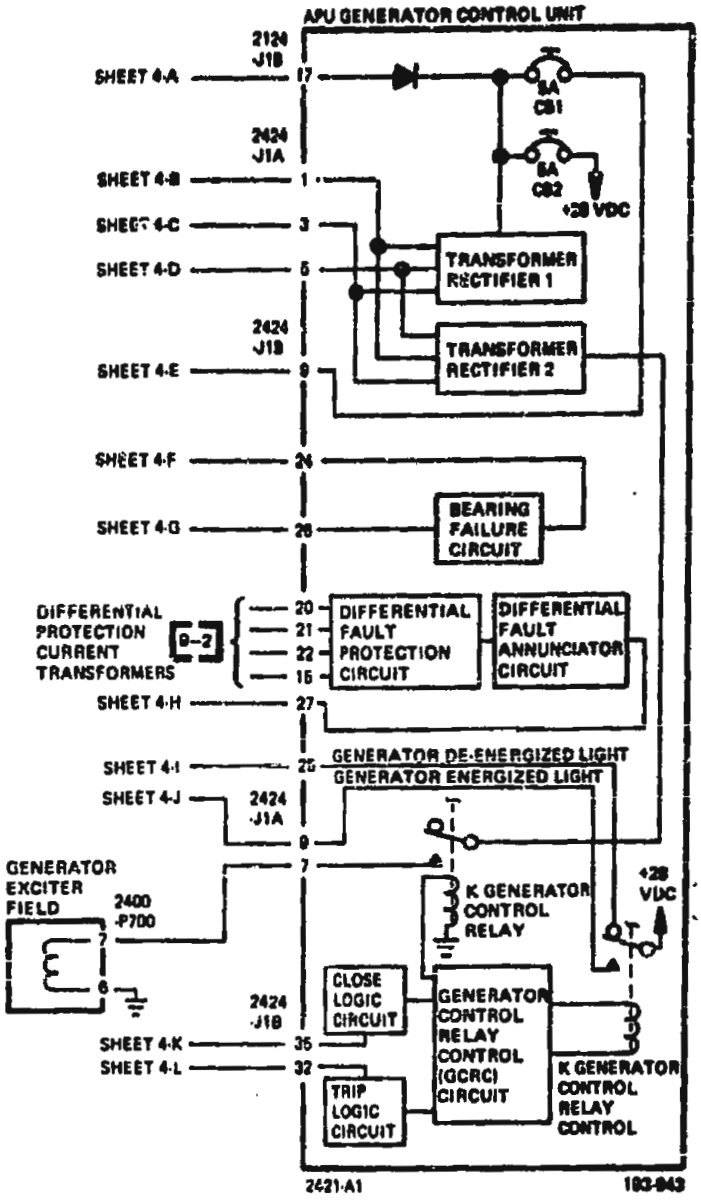
001B



R Generator Field Control and Indication Schematic
R SCHEM 1 (Sheet 4)

EFFECTIVITY: ALL

001B



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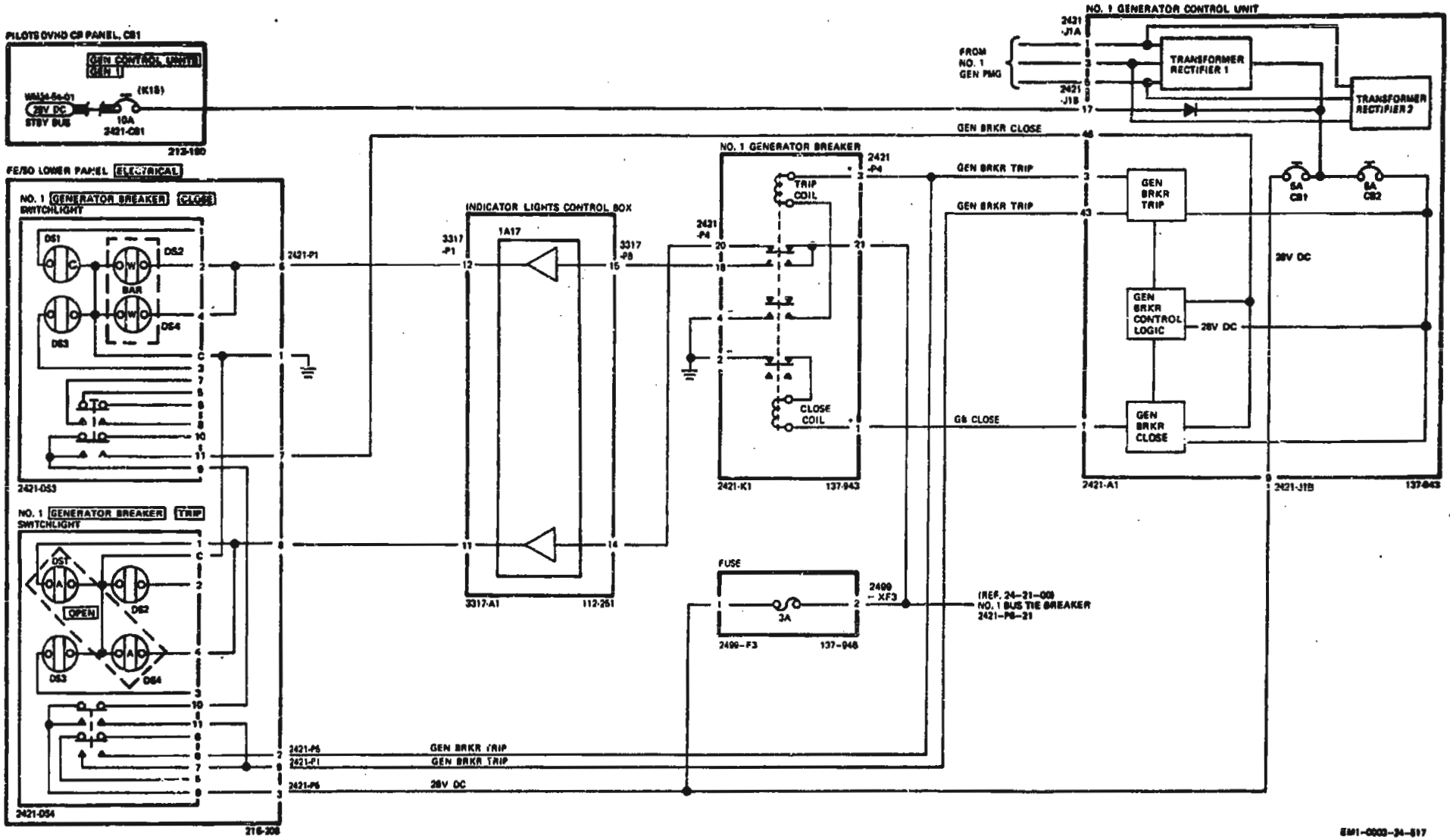
R Generator Field Control and Indication Schematic
R SCHEM 1 (Sheet 5)

EFFECTIVITY: ALL

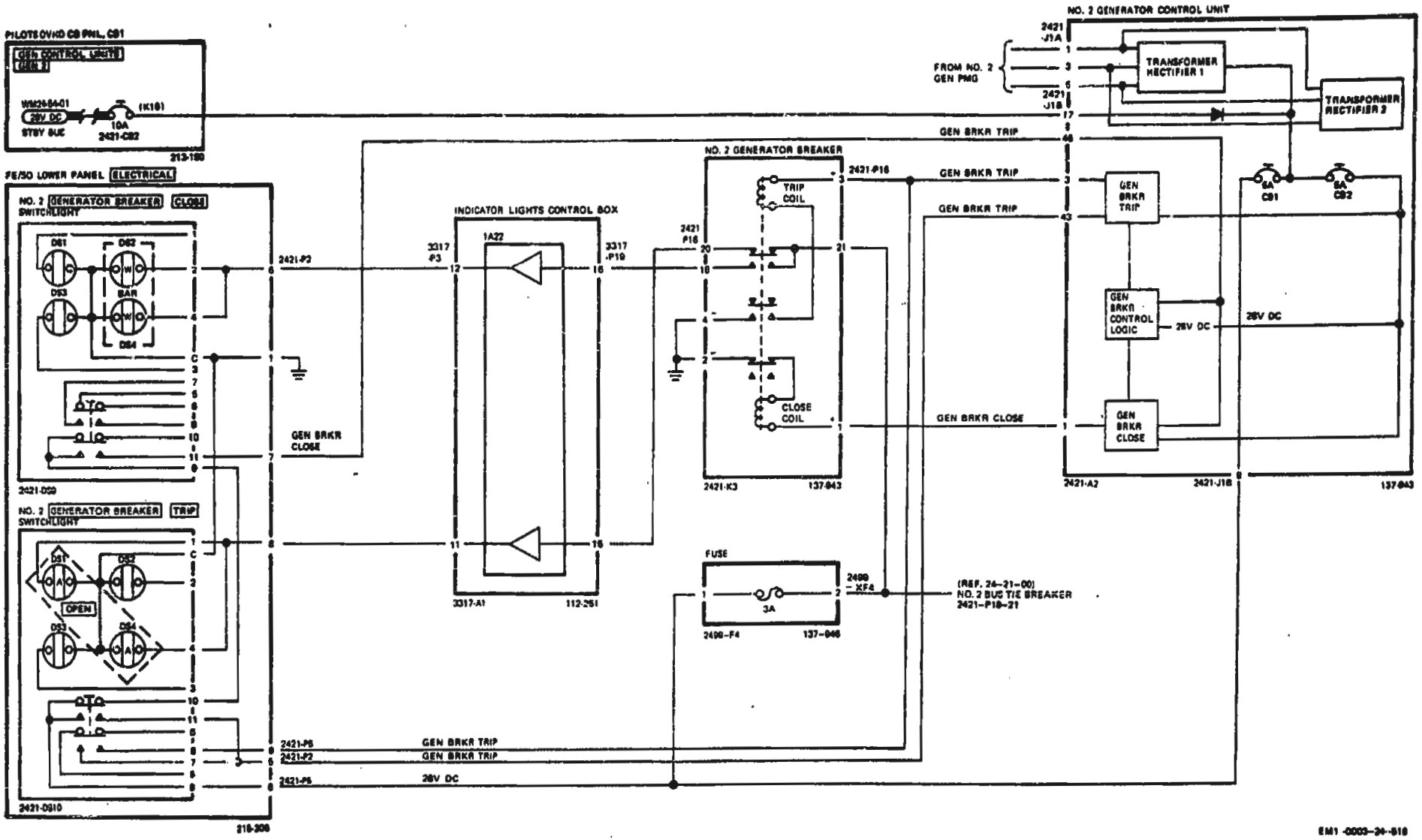
001B



R Generator Breaker Control and Indication Schematic
R SCHEM 2 (Sheet 1)

EFFECTIVITY: ALL

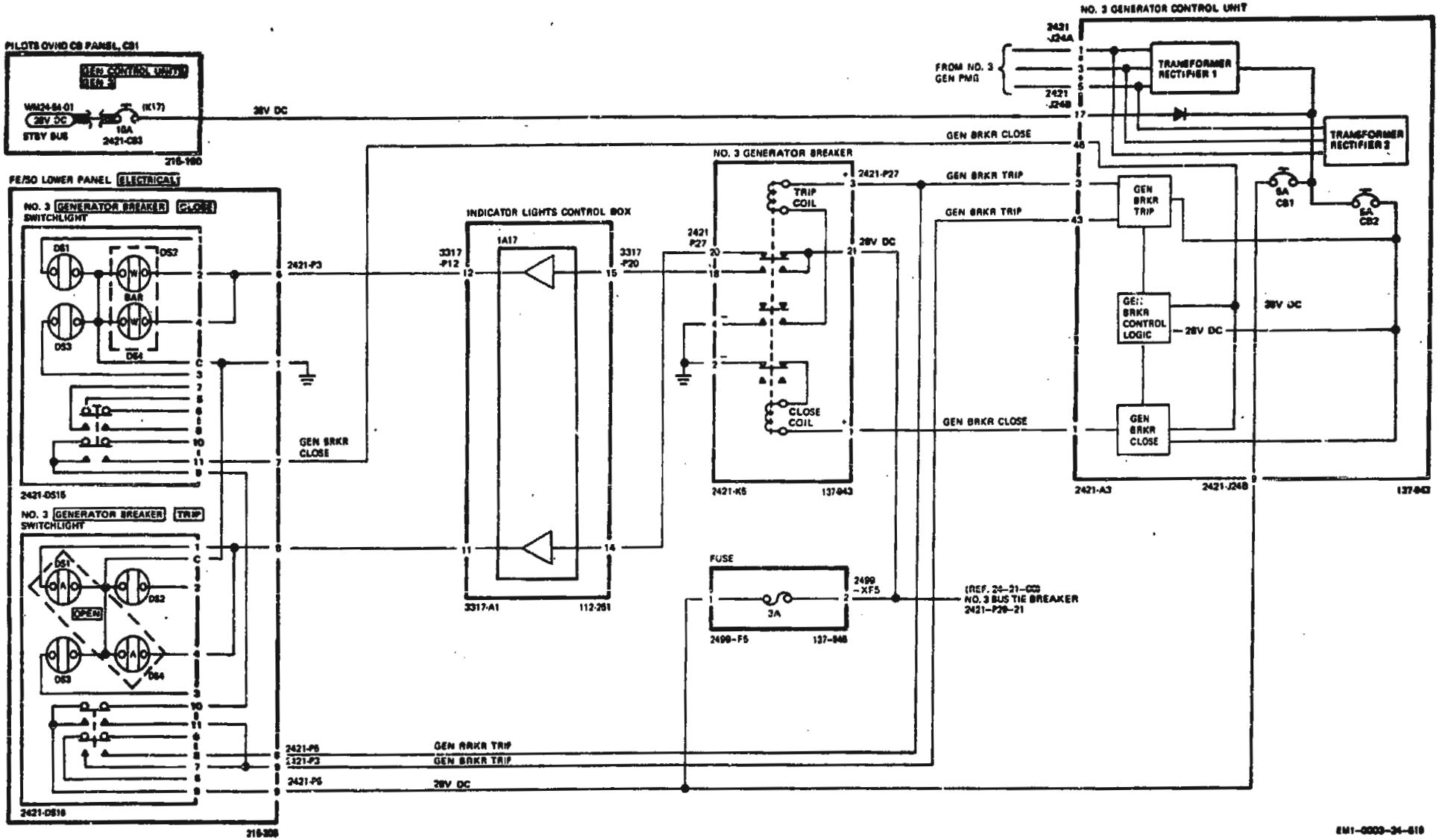
001B



R Generator Breaker Control and Indication Schematic
R SCHEM 2 (Sheet 2)

EFFECTIVITY: ALL

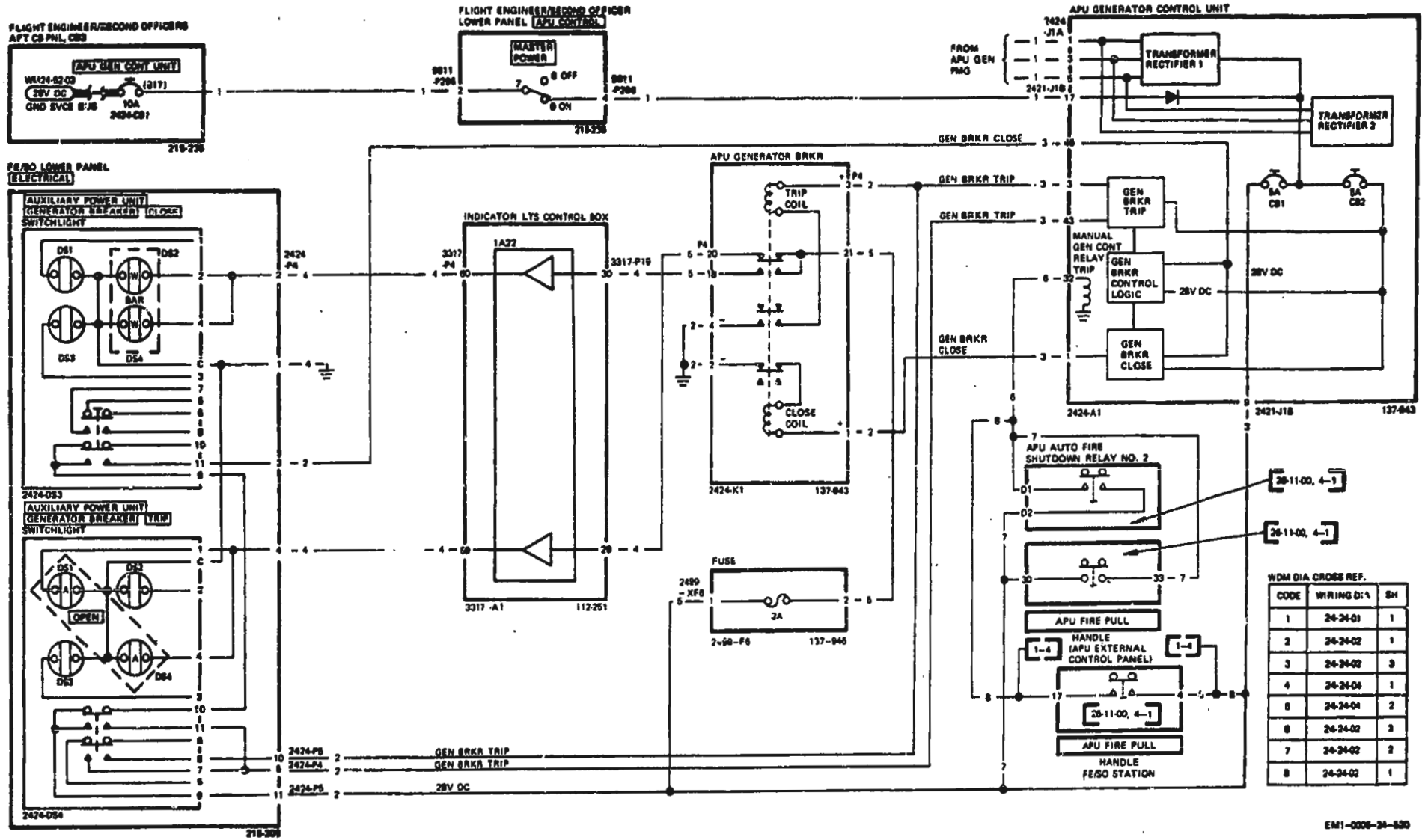
001B



R Generator Breaker Control and Indication Schematic
R SCHEM 2 (Sheet 3)

EFFECTIVITY: ALL

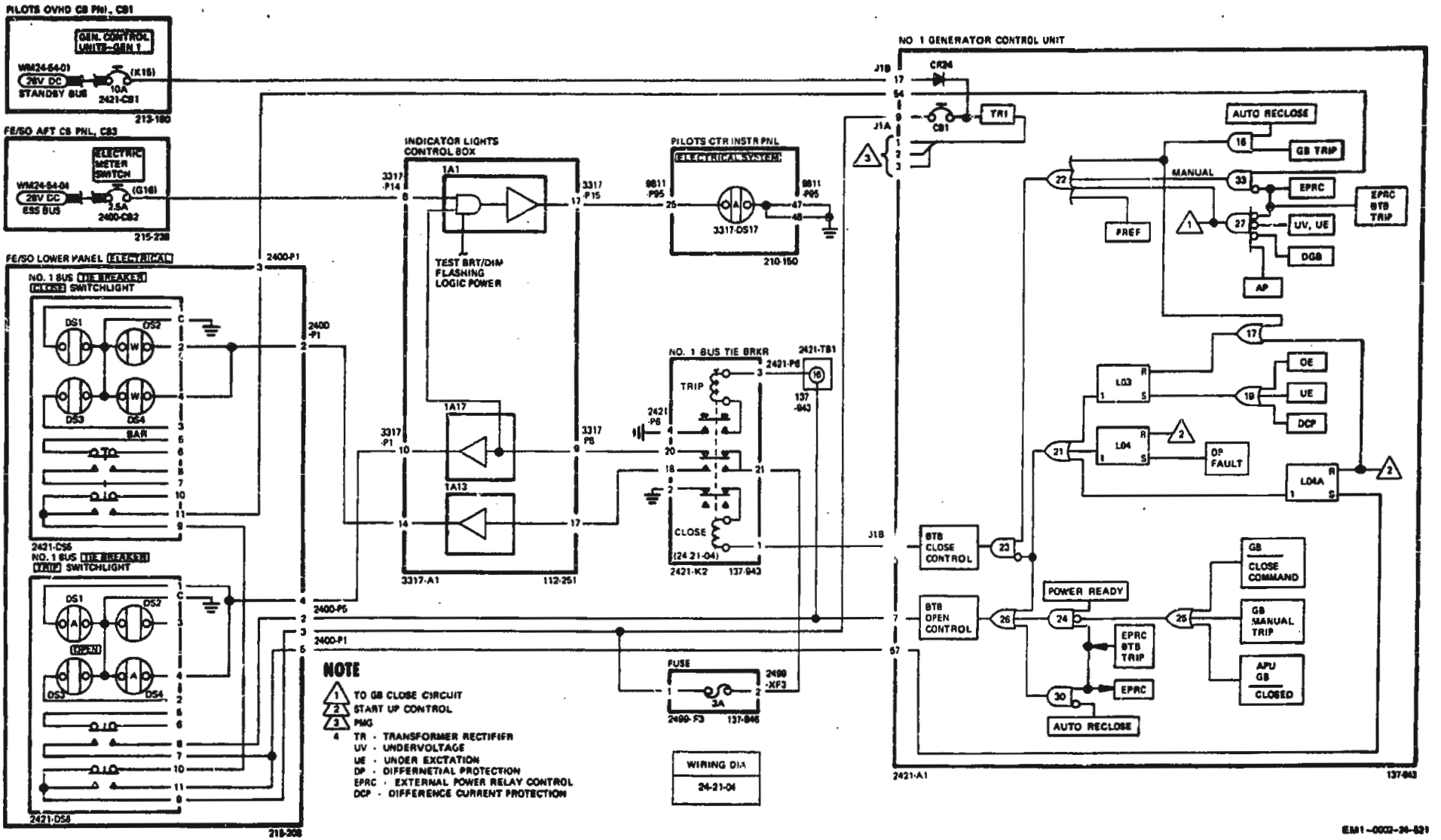
001B



R Generator Breaker Control and Indication Schematic
R SCHEM 2 (Sheet 4)

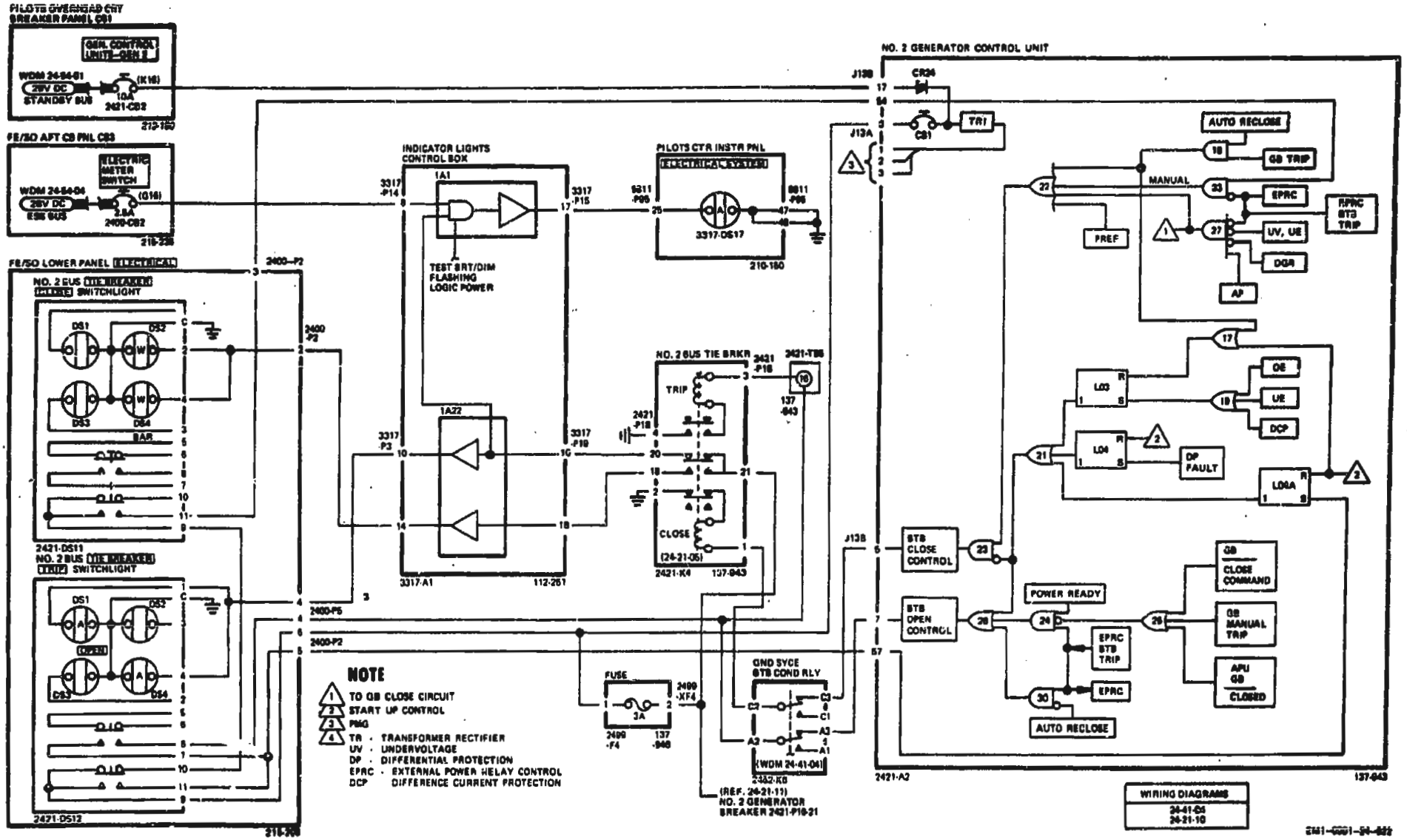
EFFECTIVITY: ALL

001B



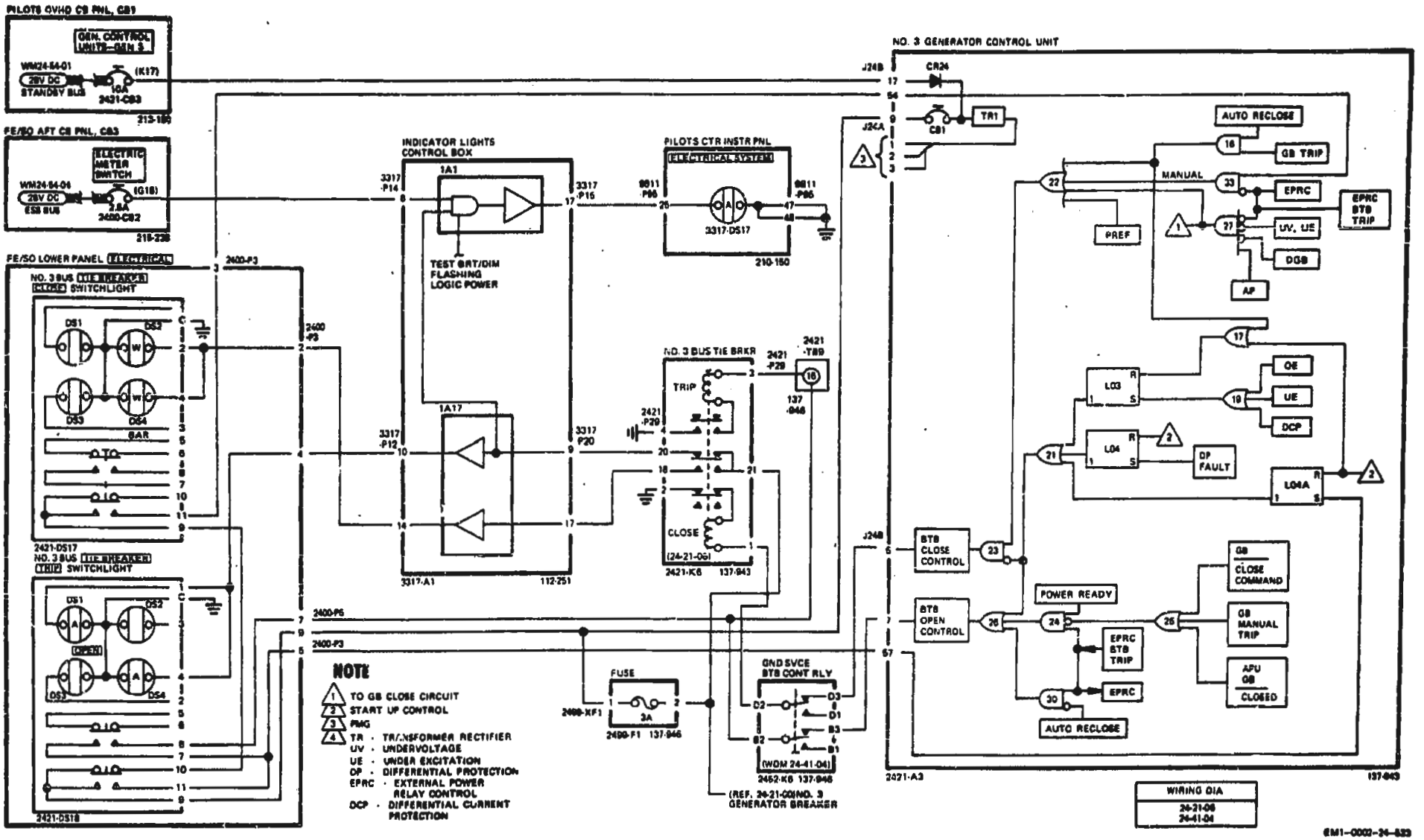
AC Bus Tie Breaker Control and Indication Schematic
SCHEM 3 (Sheet 1)

R EFFECTIVITY: ALL
R
0018



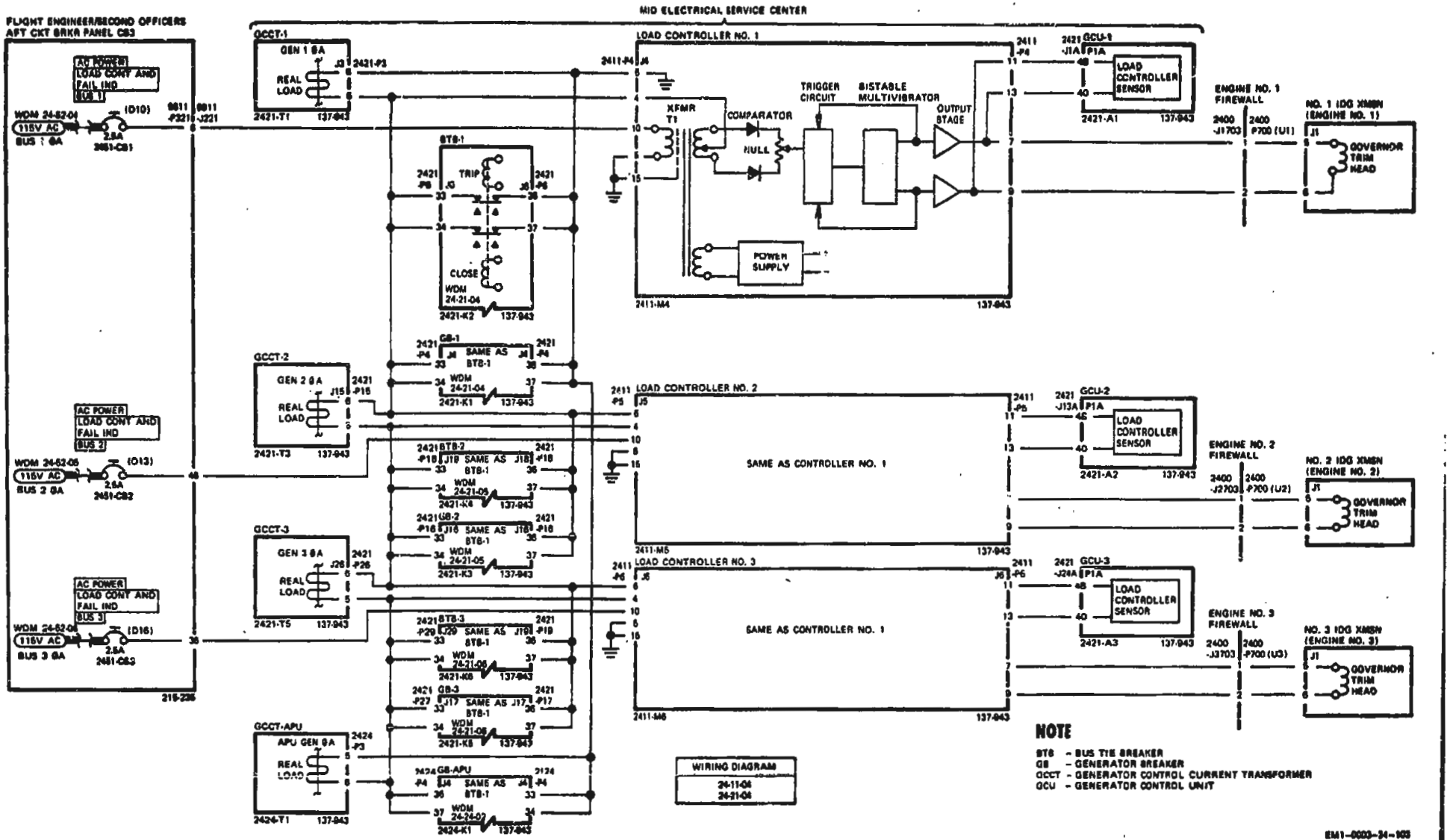
AC Bus Tie Breaker Control and Indication Schematic
SCHEM 3 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



AC Bus Tie Breaker Control and Indication Schematic
SCHEM 3 (Sheet 3)

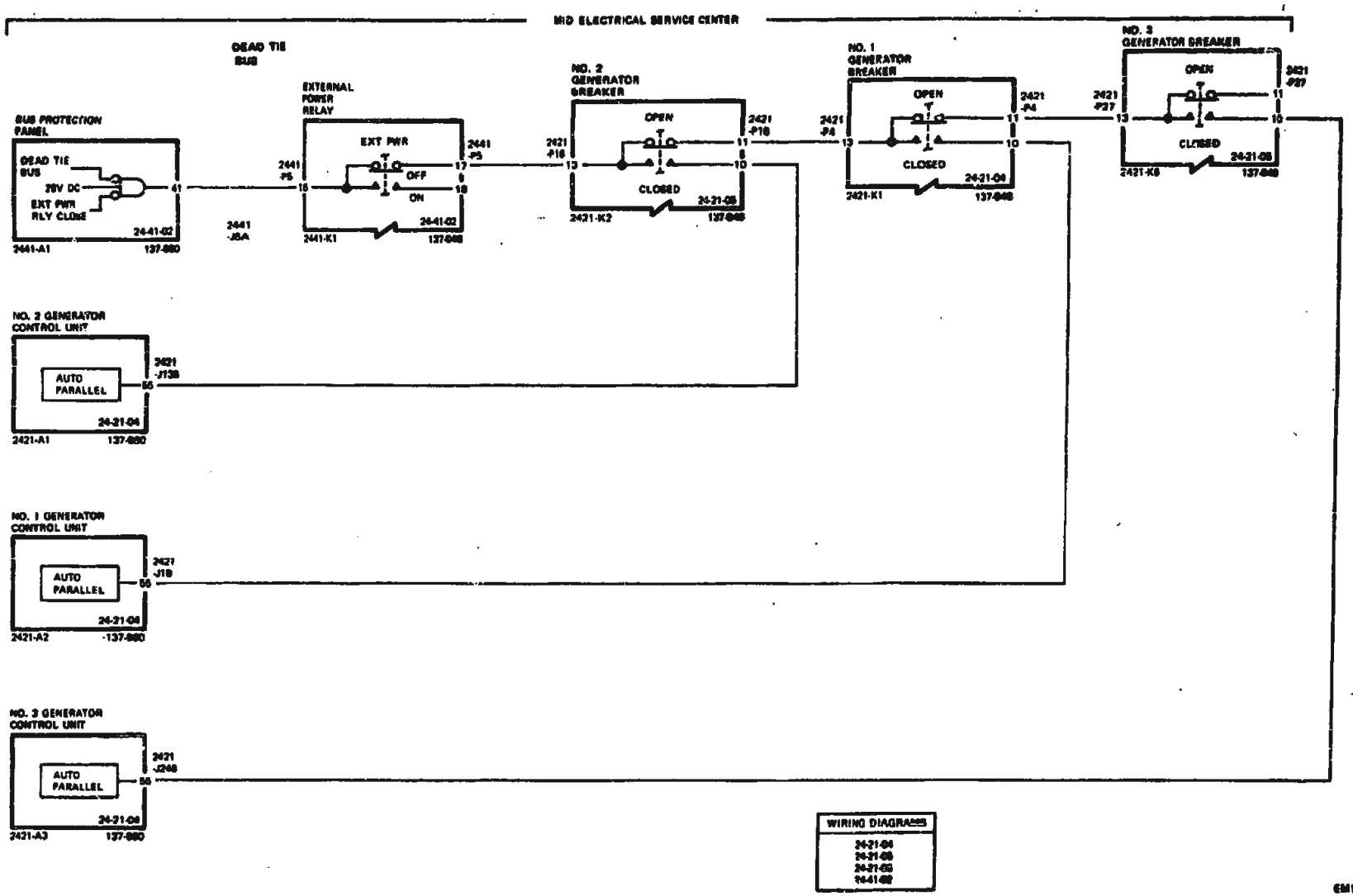
R EFFECTIVITY: ALL
R
001B



R Real Load Division Schematic
R SCHEM 4

EFFECTIVITY: ALL

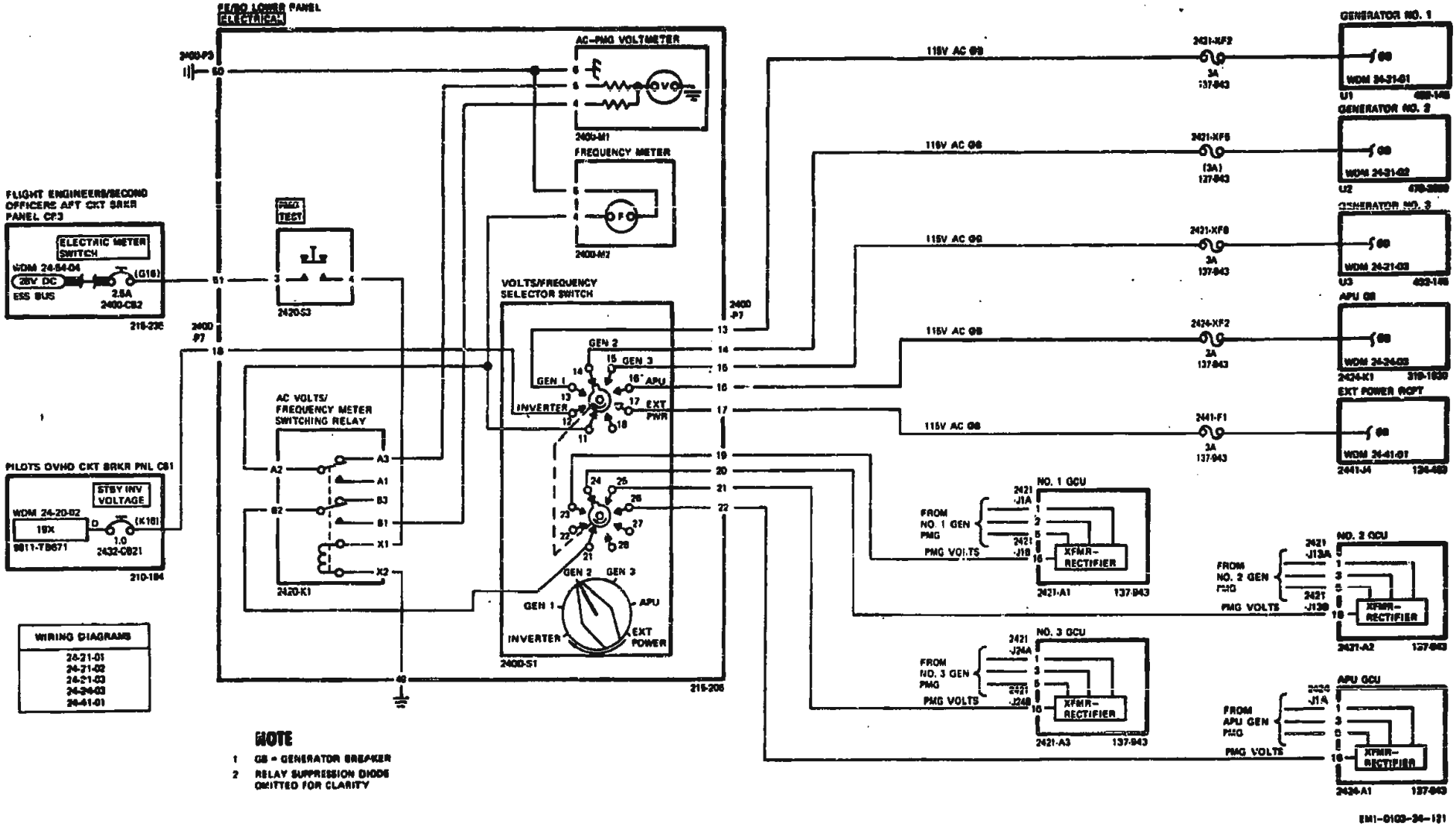
001B



G 1072
EM1-0101-24-072

Generator Preferential Circuit Schematic
SCHEM 5

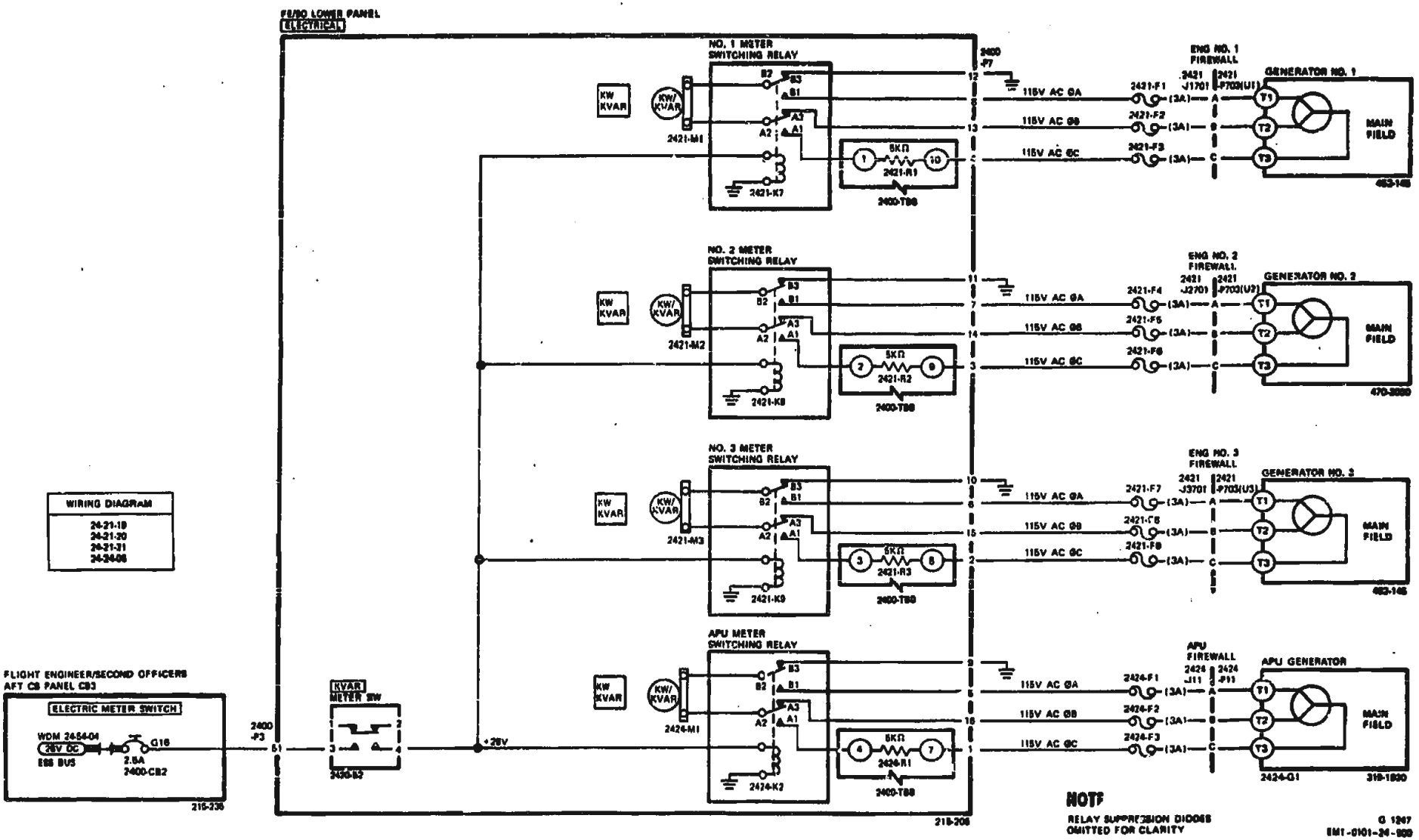
R EFFECTIVITY: ALL
R
001B



EM1-0103-24-121

Voltage and Frequency Indication Schematic
SCHEM 6

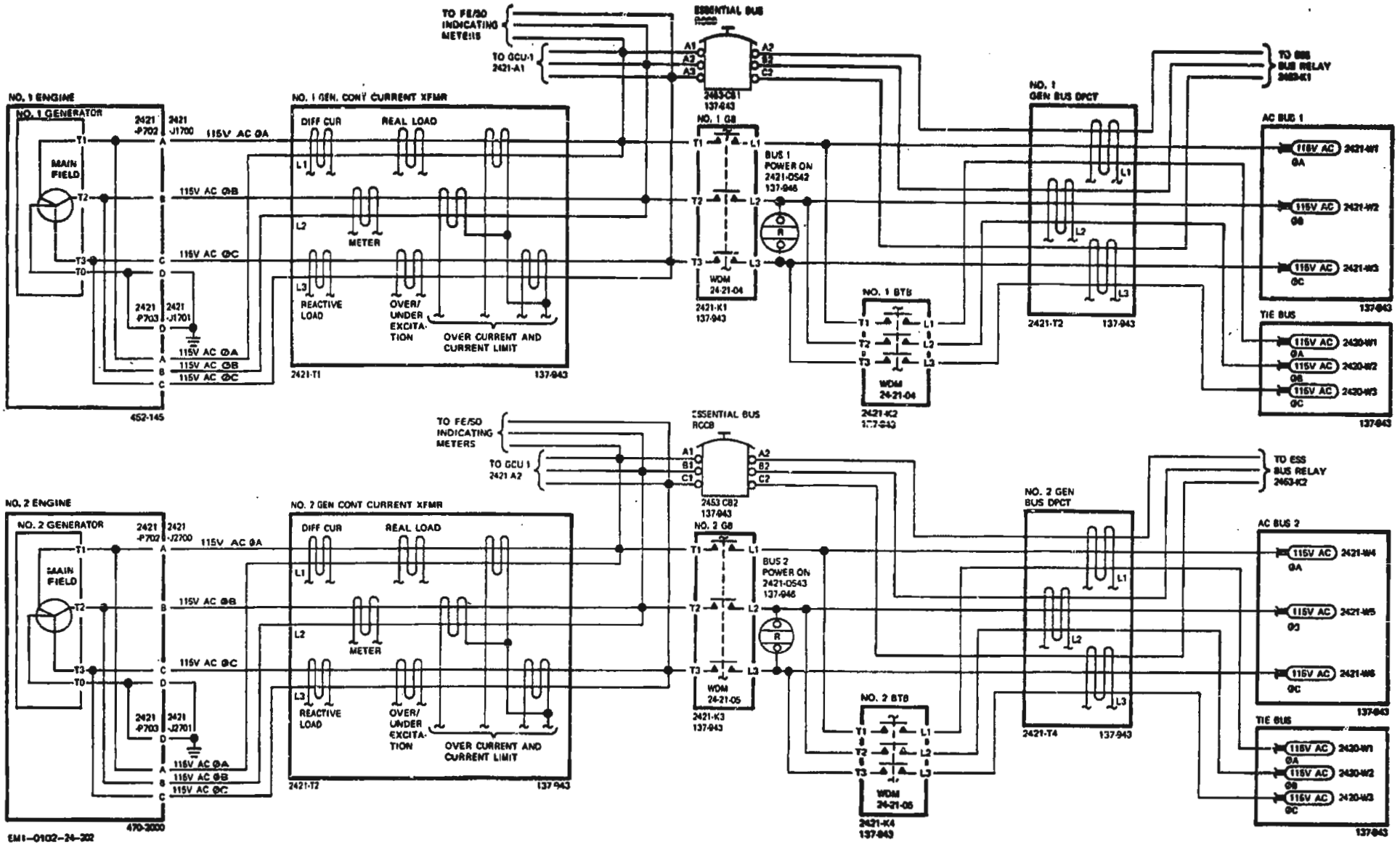
R EFFECTIVITY: ALL
R
001B



KW/KVAR Indicating System Schematic
SCHEM 7

EFFECTIVITY: ALL

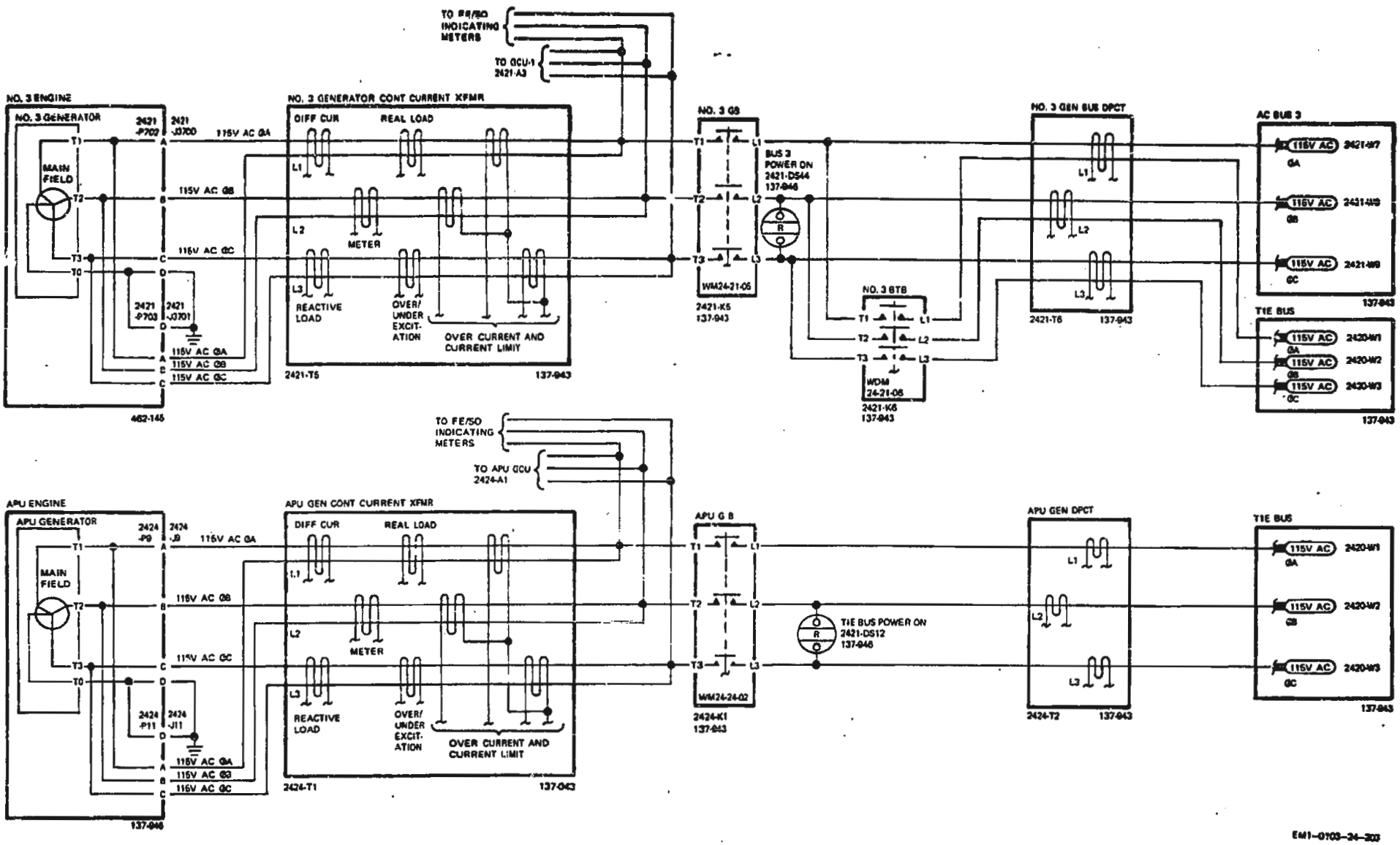
RR
001B



R Generator Feeder System Schematic
R SCHEM 8 (Sheet 1)

EFFECTIVITY: ALL

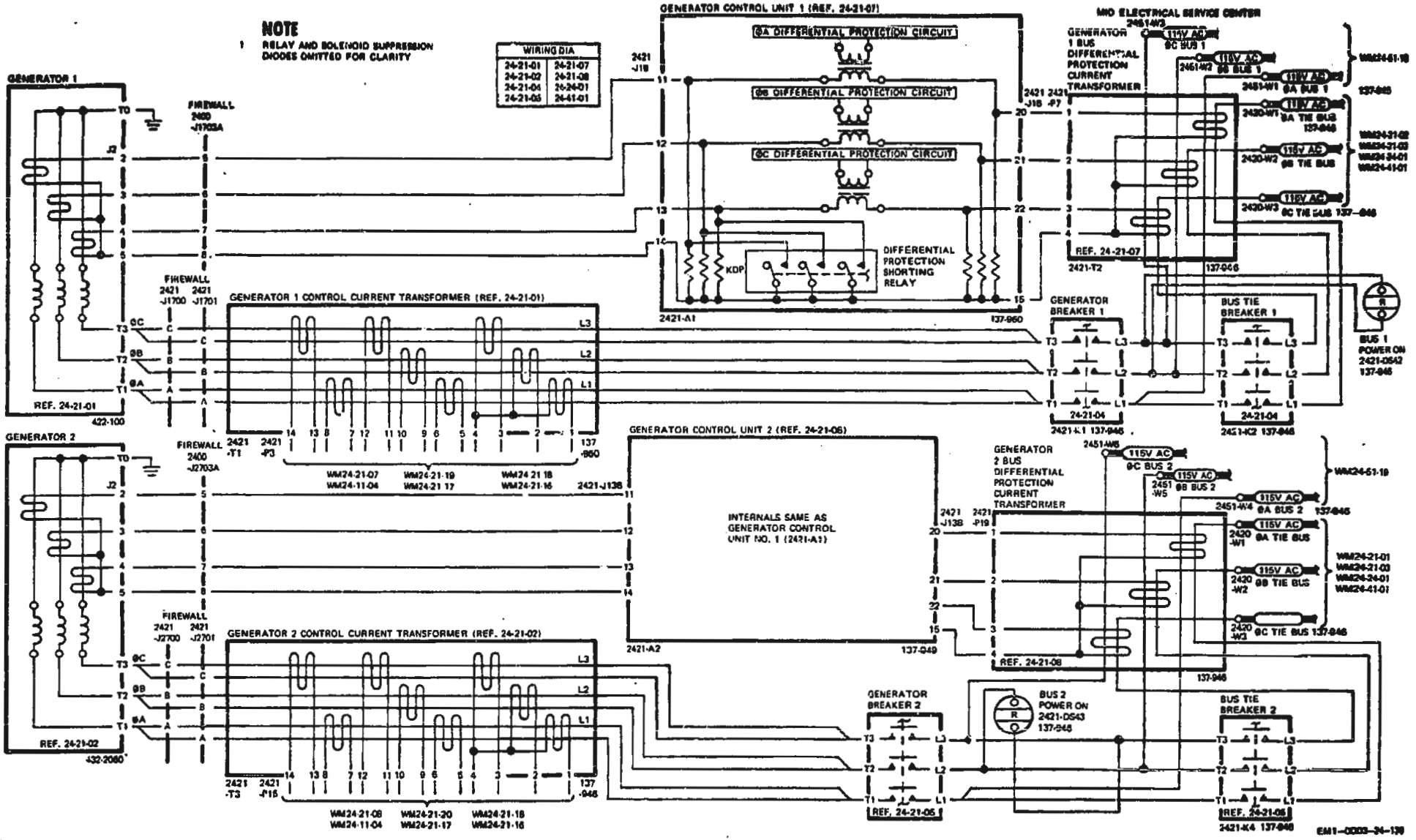
0018



R Generator Feeder System Schematic
R SCHEM 8 (Sheet 2)

EFFECTIVITY: ALL

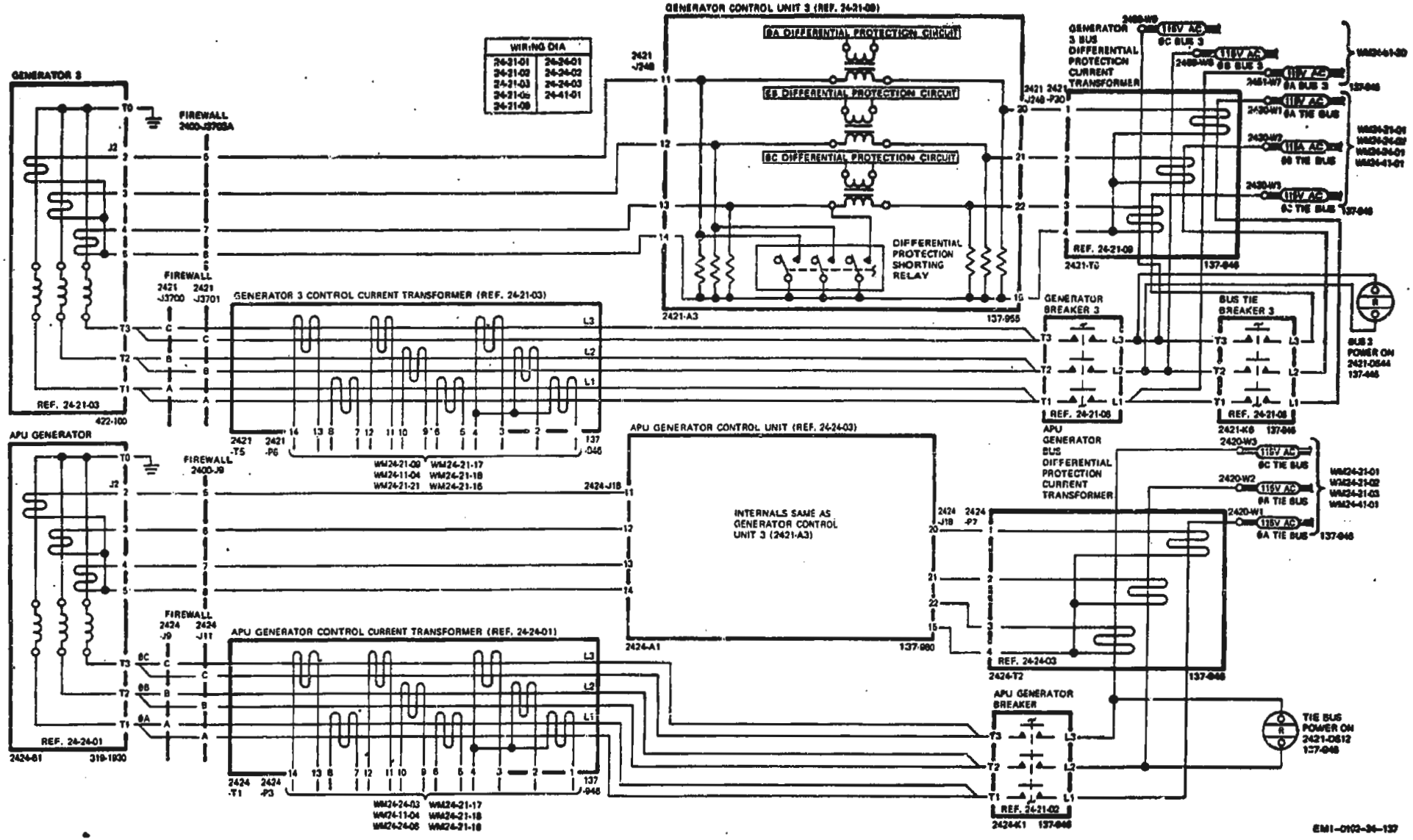
001B


NOTE
1 RELAY AND SOLENOID SUPPRESSION DIODES OMITTED FOR CLARITY
WIRING DIA
24-21-01 24-21-07
24-21-02 24-21-08
24-21-04 24-24-01
24-21-05 24-41-01
GENERATOR 1
GENERATOR 2
GENERATOR CONTROL UNIT 1 (REF. 24-21-07)
GENERATOR CONTROL UNIT 2 (REF. 24-21-08)
ØA DIFFERENTIAL PROTECTION CIRCUIT
ØB DIFFERENTIAL PROTECTION CIRCUIT
ØC DIFFERENTIAL PROTECTION CIRCUIT
KDP
DIFFERENTIAL PROTECTION SHORTING RELAY
MID ELECTRICAL SERVICE CENTER
GENERATOR 1 BUS DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
GENERATOR 2 BUS DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
GENERATOR 1 CONTROL CURRENT TRANSFORMER (REF. 24-21-01)
GENERATOR 2 CONTROL CURRENT TRANSFORMER (REF. 24-21-02)
INTERNALS SAME AS GENERATOR CONTROL UNIT NO. 1 (2421-A1)
GENERATOR BREAKER 1
BUS TIE BREAKER 1
GENERATOR BREAKER 2
BUS TIE BREAKER 2
BUS 1 POWER ON 2421-DS42 137-946
BUS 2 POWER ON 2421-DS43 137-946
FIREWALL 2400 -J1703A
FIREWALL 2400 -J2703A
115V AC ØC BUS 1
115V AC ØB BUS 1
115V AC ØA BUS 1
115V AC ØA TIE BUS
115V AC ØB TIE BUS
115V AC ØC TIE BUS
115V AC ØC BUS 2
115V AC ØB BUS 2
115V AC ØA BUS 2
REF. 24-21-01
REF. 24-21-02
REF. 24-21-04
REF. 24-21-05
REF. 24-21-07
REF. 24-21-08

Differential Protection Schematic
SCHEM 9 (Sheet 1)

EFFECTIVITY: ALL

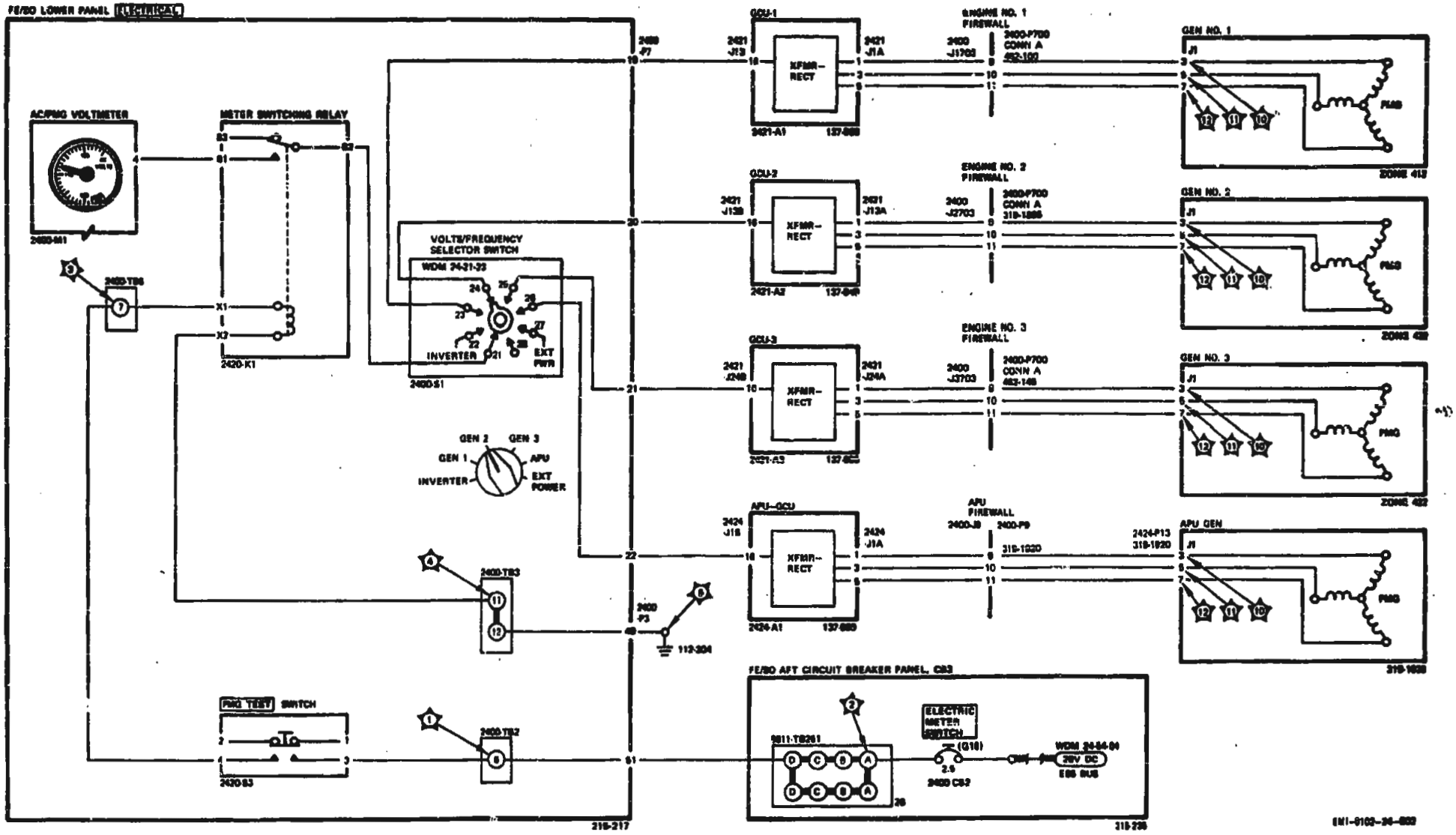
0018



R Differential Protection Schematic
R SCHEM 9 (Sheet 2)

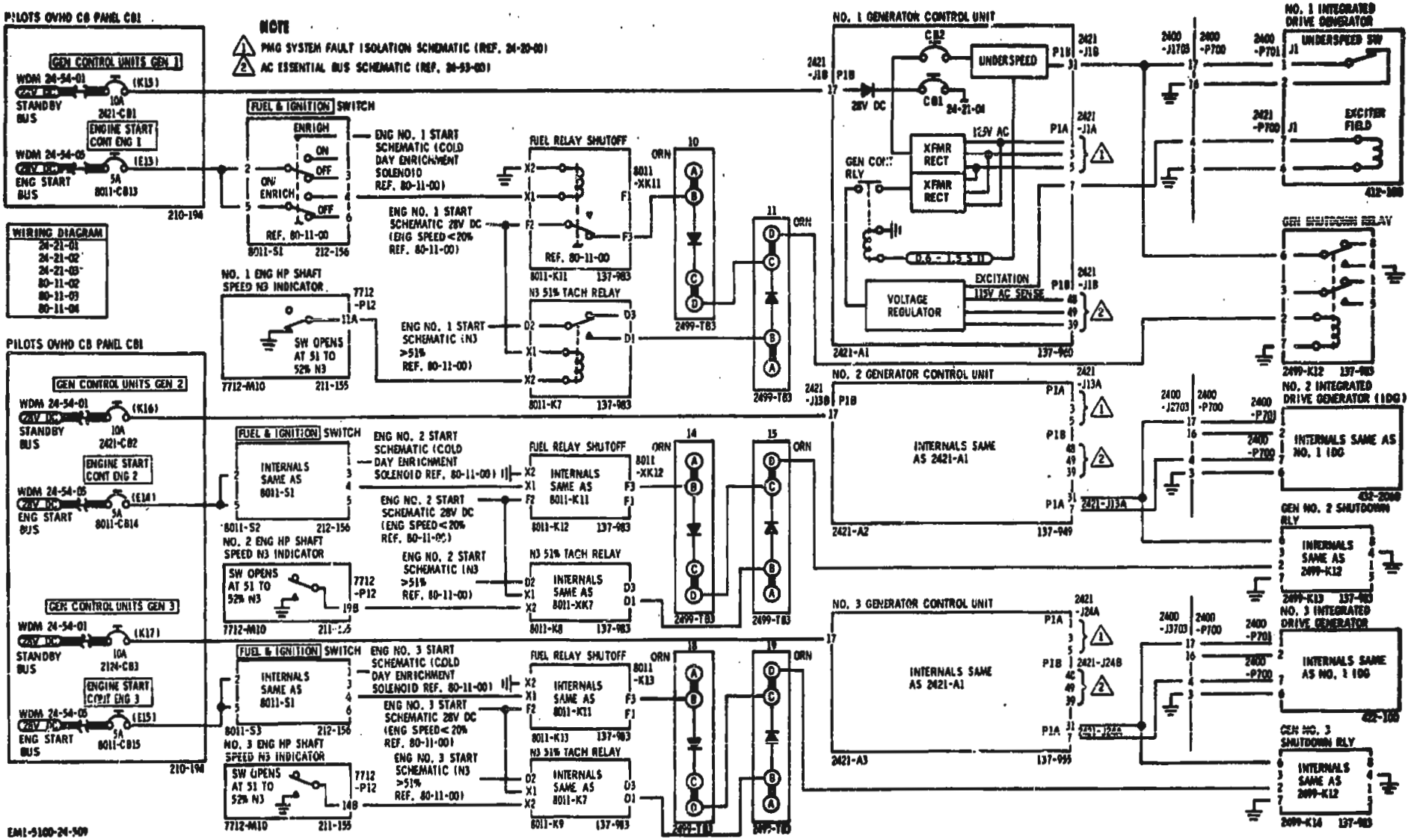
EFFECTIVITY: ALL

001B



PMG System Schematic
SCHEM 10

R EFFECTIVITY: ALL
R
001B



AC Generation Speed Shutdown System Fault Isolation Schematic
SCHEM 11

R EFFECTIVITY: ALL
R
001B

ENGINE-DRIVEN GENERATOR SYSTEM - MAINTENANCE PRACTICES

1. Referenced Procedures

24-24-00	APU Generator System - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices
49-00-01	Airborne Auxiliary Power Maintenance Practices
71-00-00	Engine Starting System - Adjustment and Test

2. Maintenance Practices

WARNING: BEFORE ENERGIZING ELECTRICAL SYSTEM, VERIFY THAT ALL CONCERNED PERSONNEL ARE NOTIFIED. HIGH VOLTAGES CAN BE FATAL.

The following procedures cover the application of engine-driven generator power to the aircraft. These procedures assume that all systems are operating normally. If the system fails to operate as indicated, refer to the applicable fault isolation procedures.

A. Application of Power with External Power Available

(1) On pilots overhead circuit breaker panel CB1, zone 210, verify that the following circuit breakers are closed:

STANDBY DC - CONT and PWR (B12 and B13)

ENGINE START PWR (B15)

AIR OVBD (J14)

AC STBY BUS SENSE (K10)

AC ESS BUS CONT (K11)

ENGINE START BUS IND (K12)

DC STBY IND (K13)

GEN CONTROL UNITS - GEN. 1, 2, and 3 (K15, K16, and K17)

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit

breakers IND LT - F/E PANEL - LOWER (J4) and BAT CHG INTLK (L6) are closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that the following circuit breakers are closed:

TIE BUS CONT - BUS 1, BUS 2, and BUS 3 (A9, A10, and A11)

TIE BUS PWR - BUS 1, BUS 2, and BUS 3 (A12, A13, and A14)

BAT CHG (A15)

R BUS 3 GALLEY PWR (A16)

GND SVCE GALLEY EXT (A17)

APU T/R PWR (B11)

APU GEN CONT UNIT (B17)

LOAD CONT & FAIL IND - BUS 1, BUS 2, and BUS 3 (D10, D13, and D16)

FLIGHT STA PWR - BUS 1, 2, and 3 (E9, E10, and E11)

ESS PWR - GEN 1, 2, and 3 (E12, E13, and E14)

T/R PWR - 1, 2, and 3 (E16, E17, and E18)

DC STBY PWR (F1)

DC TIE BUS - CONT and PWR (F2 and F3)

ENG START PWR (F10)

AC STBY BUS PWR (F12)

BUS SENSING AC BUS (F14)

ESS T/R PWR (F17)

AC BUS IND (G11)

DC AUTO XFR (G13)

GEN OVERLOAD PROTECT (G14)

IDG DISC (G15)

ELECTRIC METER SWITCH (G16)

PASS SVCE - BUS 1 - L and R (Z9 and Z10)

FWD AC GND SVCE BUS (Z11)

PASS SVCE - BUS 2 and BUS 3 (Z15 and Z16)

IDG OIL - LOW PRESS and TEMP (AA17 and AA18)

On galley left circuit breaker panel, zone 130, verify that circuit breaker PNL BUS PROTECT is closed. On front of each generator control unit and on the bus protection panel, zone 137, verify that circuit breakers CB1 and CB2 are closed.

(2) Apply external power (Ref. 24-41-00).

(3) Start engine(s) (Ref. 71-00-00).

R CAUTION: IF IDG OIL LOW-PRESS LIGHT DOES NOT GO OFF, SHUT DOWN ENGINE AND INVESTIGATE CAUSE.

(4) Verify that LOW PRESS light in IDG DISCONNECT switchlight on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, goes off by the time the engine reaches idle speed.

NOTE: As engine reaches idle speed, the generator automatically energizes and takes over its bus, and the light bars in GENERATOR FIELD CLOSE and GENERATOR BREAKER CLOSE switchlights and OPEN indicator in TIE BREAKER switchlight, all located on the electrical control panel, come on.

(5) Remove external power (Ref. 24-41-00).

NOTE: Engine generator bus(es) automatically connect to tie bus, the TIE BREAKER OPEN indicator lights go off, and the light bars come on.

If more than one engine-driven generator is operating, the generators automatically parallel and share the load.

B. Application of Engine-driven generator Power with APU Power Available

(1) Verify that circuit breakers listed in Step 2A(1) are closed.

(2) Apply APU generator power (Ref. 24-24-00).

(3) Start engine(s) (Ref. 71-00-00).

R CAUTION: IF IDG OIL LOW-PRESS LIGHT DOES NOT GO OFF, SHUT DOWN ENGINE AND INVESTIGATE CAUSE.

(4) Verify that LOW PRESS light in IDG DISCONNECT switchlight goes off by the time the engine reaches idle speed.

NOTE: As engine reaches idle speed, the generator parallels with the APU generator, and the bar lights in GENERATOR FIELD CLOSE and GENERATOR BREAKER CLOSE switchlights come on.

(5) Unless continued APU generator operation is desired, remove APU generator power (Ref. 24-24-00).

C. Removal of Engine-driven Generator Power from Buses

NOTE: Any engine-driven generator automatically deenergizes its associated bus when the engine is shut down.

(1) To remove any generator from its bus with the engine running, press applicable GENERATOR FIELD TRIP switchlight. The generator deenergizes and the generator breaker automatically trips. However, the bus will automatically continue to be energized by the tie bus from any other available source such as another engine-driven generator, the APU generator, or external power.

NOTE: To restore the generator to its bus press GENERATOR FIELD CLOSE switchlight.

IDG ASSEMBLY - MAINTENANCE PRACTICES

1. General

If an aircraft is to be dispatched with one IDG inoperative, the bus tie system, the overload protection system and all other automatic and manual control functions must be operative.

2. Referenced Procedure

24-11-01 IDG Transmission - Maintenance Practices

3. Deactivation

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

A. Procedure

(1) Disconnect inoperative IDG (Ref. 24-11-01).

R IDG ASSEMBLY - ADJUSTMENT AND TEST

R 1. Referenced Procedures

R 24-11-01 IDG Assembly - Adjustment and Test

R 2. Operational Check of Disconnect (Ref. 24-11-01 PARA 3B and 3C)

GENERATOR CONTROL UNIT - REMOVAL AND INSTALLATION

1. Referenced Procedures

R R	6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
R R	6-50-00	Interior Access Doors and Removable Panels - Description and Operation
	20-23-02	Rack Mounted ARINC Box Lever Latch - Maintenance Practices
	24-00-00	Electrical Power - Maintenance Practices
	24-20-00	AC Generation - Adjustment and Test
R	24-51-00	AC Bus System

2. Removal/Installation

A. Removal

R R R (1) If generator is rotating press FIELD TRIP switchlight on Flight Engineer/Second Officers ELECTRICAL panel, zone 215, and verify that FIELD TRIP-OPEN light comes on.

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable GEN CONTROL UNITS circuit breaker (K15, K16, or K17).

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag APU GEN CONT UNIT circuit breaker (B17).

R R (3) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

R (4) Open and tag two circuit breakers located on GCU.

R CAUTION: DO NOT REMOVE A GENERATOR CONTROL UNIT WHILE GENERATOR IS ROTATING UNLESS GENERATOR FIELD HAS BEEN OPENED.

(5) Release quick-release latch on GCU to be removed and pull unit out of rack.

NOTE: Generator control units are located in left and right MESC racks: No. 1 - left rack center shelf, No. 2 - right rack top shelf, No. 3 - right rack bottom shelf, and APU - left rack lower shelf.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Position GCU in rack and gently slide outboard until connectors align.

(3) Push GCU firmly into position and latch quick-release hold-in mechanism in handle (Ref. 20-23-02).

(4) Remove tag and close circuit breakers opened in Step 2A(1).

(5) Turn on electrical system (Ref. 24-00-00).

(6) Press PANEL TEST and then PANEL RESET switches on generator system failure annunciator panel, zone 137. All indicators must turn yellow when PANEL TEST switch is pressed, and black when PANEL RESET switch is pressed.

R WARNING: INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT CAN
R OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED
R FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL
R SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE
R SELF TEST SWITCH

(7) Press SELF TEST switch on generator system failure annunciator panel. The SELF TEST COMPL indicator for channel being tested must turn yellow in approximately 10 to 12 seconds, and all other indicators in that channel must remain black.

NOTE: This test is good for a nonoperating channel only. If GALLEY POWER switchlights on ELECTRICAL panel, zone 215, are on (latched in) when SELF TEST switch is pressed, the FAIL light in each switchlight will come on and remain on until all three switchlights are released (out). This constitutes a functional check of the generator overload relay. The ac motor pump monitor relay (Ref. 24-51-00) will also energize).

(8) Press PANEL RESET switch to reset indicator.

(9) Close and secure access doors.

(10) Turn off electrical system (Ref. 24-00-00).

(11) Make necessary form entries for a generator functional test 24-20-00 next engine run.

GENERATOR BREAKER - MAINTENANCE PRACTICES

R 1. Maintenance Practices

A. Deactivation

R NOTE: This deactivation procedure applies only when an
R aircraft is to be dispatched in accordance with the
R MEL

WARNING: REMOVE ALL ELECTRICAL POWER FROM AIRCRAFT BEFORE PERFORMING THIS PROCEDURE.

(1) On pilots center console, zone 210, verify that FUEL AND IGNITION switches are in the OFF position and tagged.

(2) On the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, verify that EXT PWR switch is in the OFF position and tagged.

(3) On the APU CONTROL panel, zone 215, verify that MASTER POWER switch is in the OFF position and tagged.

(4) Open access doors 192K and 137AZ and enter mid electrical service center, zone 137.

(5) Release CAMLOC fasteners and open applicable door of ac power distribution box to gain access to breaker to be deactivated.

(6) Deactivate breaker by removing protective cover and manually opening main contacts of breaker.

(7) Reinstall protective cover, close ac power distribution box door and access doors 192K and 137AZ.

(8) Remove tags installed in Steps 1A(1) through 1A(3).

(9) Install tag on appropriate GENERATOR BREAKER switchlights to prevent closure.

(10) Install placard on ELECTRICAL panel.

(11) Make appropriate entry in aircraft log book.

ENGINE-DRIVEN GENERATOR BREAKER AND BUS TIE BREAKER REMOVAL AND INSTALLATION

1. General

Removal and installation procedures for generator breakers and bus tie breakers are different. If replacing a generator breaker, see Step 3. If replacing a bus tie breaker, see Step 4.

2. Referenced Procedures

R 6-40-00 Exterior Access Doors and Removable Panels -
R Description and Operation

R 6-50-00 Interior Access Doors and Removable Panels -
R Description and Operation

24-41-00 External Power/Ground Service System - Maintenance Practices

71-00-00 Power Plant - Adjustment and Test

3. Removal/Installation - Generator Breaker

A. Removal

(1) On the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breakers APU BAT BUS - CONT PWR and IGNITION (S12) and (S11).

(2) On the pilots center console, zone 210, verify that FUEL AND IGNITION switches are in the OFF position and tagged.

(3) On the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, place EXT PWR switch in the OFF position and tag.

R (4) Turn off external power source (Ref. 24-41-00).

(5) Remove external plug from receptacle located on the lower fuselage just aft of the nosewheel well at FS 458, and tag receptacle.

R (6) Gain access to mid electrical service center zone 137
R (Ref. 6-40-00, 6-50-00). center, zone 137.

(7) Release Camloc fasteners and open applicable door of the ac power distribution box located in the mid electrical service center, to gain access to breaker to be replaced (Ref. Fig. 401).

WARNING: ALWAYS USE CAUTION IN THE AC POWER DISTRIBUTION BOX. VOLTAGES PRESENT CAN BE FATAL.

(8) Remove screws and protective cover from generator breaker (Ref. Fig. 401).

(9) Tag and remove wires from breaker terminal studs T1, T2, T3, L1, L2, and L3.

(10) Disengage electrical connector from breaker.

(11) Tag and remove screw and ground wire from breaker mounting flange.

(12) Remove remaining mounting screws and remove breaker from ac power distribution box.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Verify that control switches are properly positioned and tagged [Steps 3A(2) and 3A(3)].

(3) Position breaker (receptacle on left side) and secure with screws.

NOTE: Ground wire is secured with lower left screw.

(4) Reconnect electrical connector to breaker receptacle.

(5) Reconnect tagged wires to proper terminal studs and remove tags; torque six 3/8-24 nuts 120 to 140 lb in..

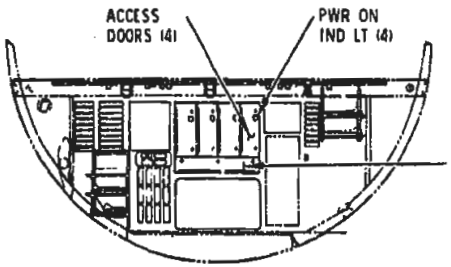
(6) Position protective cover and secure with screws.

(7) Close and secure door of the ac power distribution box.

R (8) Close and secure mid electrical service center access doors.

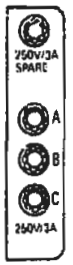
(9) Remove tag from external power receptacle.

(10) Remove tags from FUEL AND IGNITION switches (pilots center console) and EXT PWR switch (Flight Engineer/Second Officers electrical control panel).

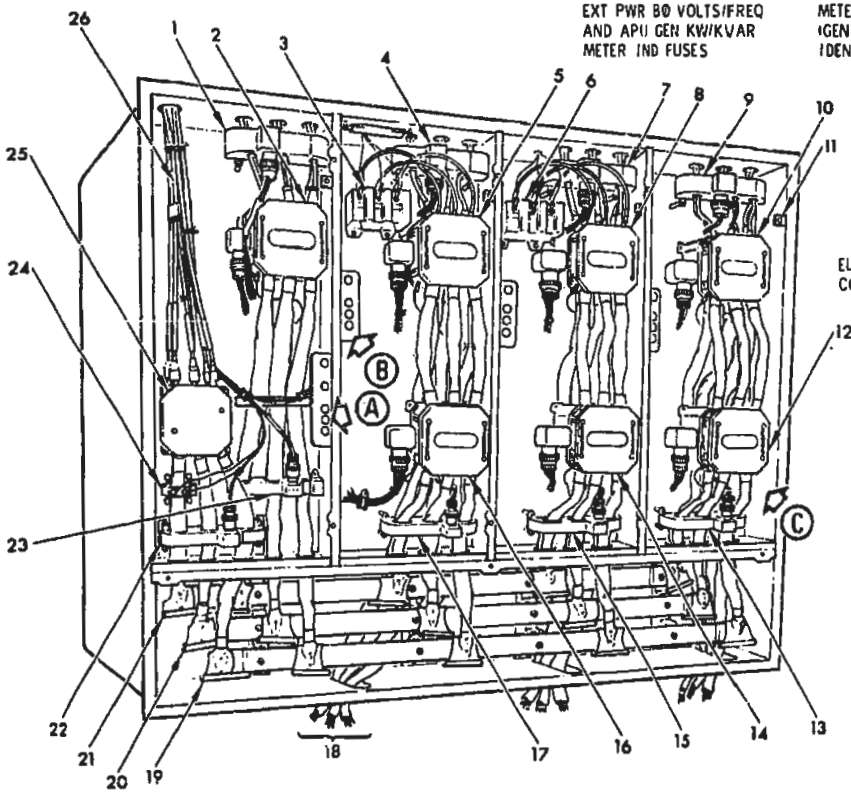


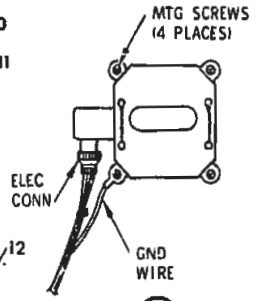
MID ELECTRICAL SERVICE CENTER
LOOKING FORWARD

Ⓐ EXT PWR BØ VOLTS/FREQ AND APU GEN KW/KVAR METER IND FUSES



Ⓑ GEN NO. 1 KW/KVAR METER IND FUSES (GEN NO. 2 AND NO. 3 IDENTICAL)





Ⓒ TYPICAL MOUNTING FOR FOUR GEN BRKR AND THREE BUS TIE BRKR

AC POWER SYSTEM DISTRIBUTION BOX COMPONENTS

ITEM NO.	NOMENCLATURE
1	APU GENERATOR CONTROL CURRENT TRANSFORMER
2	APU GENERATOR BREAKER
3	NO. 1 GENERATOR - AC ESSENTIAL BUS POWER RCCB
4	NO. 1 GENERATOR CONTROL CURRENT TRANSFORMER
5	NO. 1 GENERATOR BREAKER
6	NO. 2 GENERATOR - AC ESSENTIAL BUS POWER RCCB
7	NO. 2 GENERATOR CONTROL CURRENT TRANSFORMER
8	NO. 2 GENERATOR BREAKER
9	NO. 3 GENERATOR CONTROL CURRENT TRANSFORMER
10	NO. 3 GENERATOR BREAKER
11	POWER ON INDICATOR LIGHT (VISIBLE WITH DOOR CLOSED). TYPICAL FOR EACH OF THE FOUR POWER DISTRIBUTION PANELS
12	NO. 3 GENERATOR BUS TIE BREAKER
13	NO. 3 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
14	NO. 2 GENERATOR BUS TIE BREAKER
15	NO. 2 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
16	NO. 1 GENERATOR BUS TIE BREAKER
17	NO. 1 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
18	3Ø FEEDER WIRES TO AC BUS NO. 1. TYPICAL OF FEEDER WIRES TO AC BUS NO. 2 AND AC BUS NO. 3 FROM RESPECTIVE GENERATOR BREAKER
19	AC TIE BUS - CØ BUS
20	AC TIE BUS - BØ BUS
21	AC TIE BUS - AØ BUS
22	EXTERNAL POWER DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
23	APU GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
24	EXTERNAL POWER OVERCURRENT CURRENT TRANSFORMER - AØ
25	EXTERNAL POWER RELAY
26	EXTERNAL POWER FEEDER WIRES

WARNING

DEENERGIZE ALL GENERATORS AND DISCONNECT EXTERNAL POWER AS OUTLINED IN SECTION 24-00-00 PRIOR TO PERFORMING ANY REMOVAL/INSTALLATION PROCEDURES IN THE AC DISTRIBUTION BOX OR AC TIE BUS COMPARTMENT

NOTE

1. AC POWER DISTRIBUTION BOX DOORS AND AC TIE BUS COVER PANEL NOT SHOWN
2. POWER DISTRIBUTION PANELS ARE IDENTIFIED FROM LEFT TO RIGHT AS FOLLOWS:
   A. EXTERNAL POWER AND APU GENERATOR PANEL
   B. GENERATOR NO. 1 PANEL
   C. GENERATOR NO. 2 PANEL
   D. GENERATOR NO. 3 PANEL
3. BUS TIE BREAKERS REQUIRE MICARTA SPACERS TO ACCOMMODATE FLAT BUS FEEDERS
4. INSTALL SAFETY WIRE ON ALL BREAKER COVER SCREWS

G1139
M1-0101-24-224

R **Engine-driven Generator Breaker and Bus Tie Breaker**
R **Removal and Installation**
R **Figure 401**

(11) Remove tags and close circuit breakers opened in Step 3A(1).

R **WARNING:** BEFORE TURNING ON EXTERNAL POWER, STARTING THE APU OR ENGINE, ENSURE THAT PERSONNEL ARE NOT WORKING ON OTHER PARTS OF THE ELECTRICAL SYSTEM. VOLTAGES FROM EXTERNAL POWER SOURCE OR GENERATED BY APU OR ENGINE-DRIVEN GENERATORS CAN BE FATAL. ALSO ENSURE ALL OTHER ENGINE STARTING SAFETY PRECAUTIONS ARE OBSERVED BEFORE STARTING ANY ENGINE.

(12) Start engine No. 1, 2, or 3 (Ref. 71-00-00), as applicable.

(13) Perform the following checkout procedures to determine that the applicable breaker functions properly. All controls and indicators are located on the Flight Engineer/Second Officers ELECTRICAL control panel (Ref. Fig. 402).

(a) Press GENERATOR FIELD CLOSE switchlight and check for closed indication on GENERATOR FIELD CLOSE and GENERATOR BREAKER CLOSE switchlights (light bars on).

(b) Check for positive deflection on KW-KVAR meter (meter reading depends on load being applied).

(c) Press GENERATOR BREAKER TRIP switchlight and check that closed indication (light bar) goes off and TRIP switchlight OPEN light comes on.

(d) Press GENERATOR BREAKER CLOSE switchlight and check for closed indication (light bar) to come on and for TRIP switchlight OPEN light to go off.

(e) Press GENERATOR FIELD TRIP switchlight. Check for GENERATOR FIELD CLOSE and GENERATOR BREAKER CLOSE switchlights to indicate open (light bar goes off).

(f) Check for GENERATOR FIELD TRIP and GENERATOR BREAKER TRIP switchlights to come on indicating OPEN.

(g) If engine-generated power is not needed shut down engine (Ref. 71-00-00).

(h) Close all access doors.

4. Removal/Installation - Bus Tie Breaker

A. Removal

(1) Perform Steps 3A(1) through 3A(7).

WARNING: ALWAYS USE CAUTION IN THE AC POWER DISTRIBUTION BOX. VOLTAGES PRESENT CAN BE FATAL.

(2) Remove screws and protective cover from bus tie breaker (Ref. Fig. 401).

(3) Perform Steps 3A(9) through 3A(11).

(4) Remove remaining mounting screws and remove breaker and spacers from the ac power distribution box.

NOTE: Retain spacers for installation procedure.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

(2) Verify control switches are properly positioned and tagged [Steps 3A(2) and 3A(3)].

(3) Position spacers and breaker (breaker receptacle on left side) and secure with screws.

NOTE: Ground wire is secured with lower left screw.

R (4) Perform Steps 3B(4) through 3B(11).

(5) Turn on aircraft electrical system (Ref. 24-41-00).

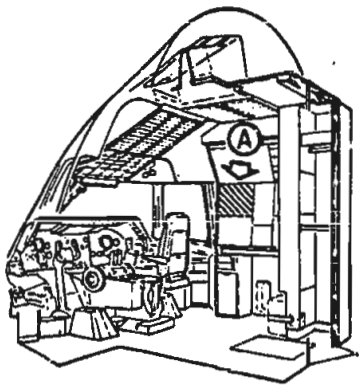
(6) Press TIE BREAKER CLOSE switchlight and check for closed indication (light bar comes on).

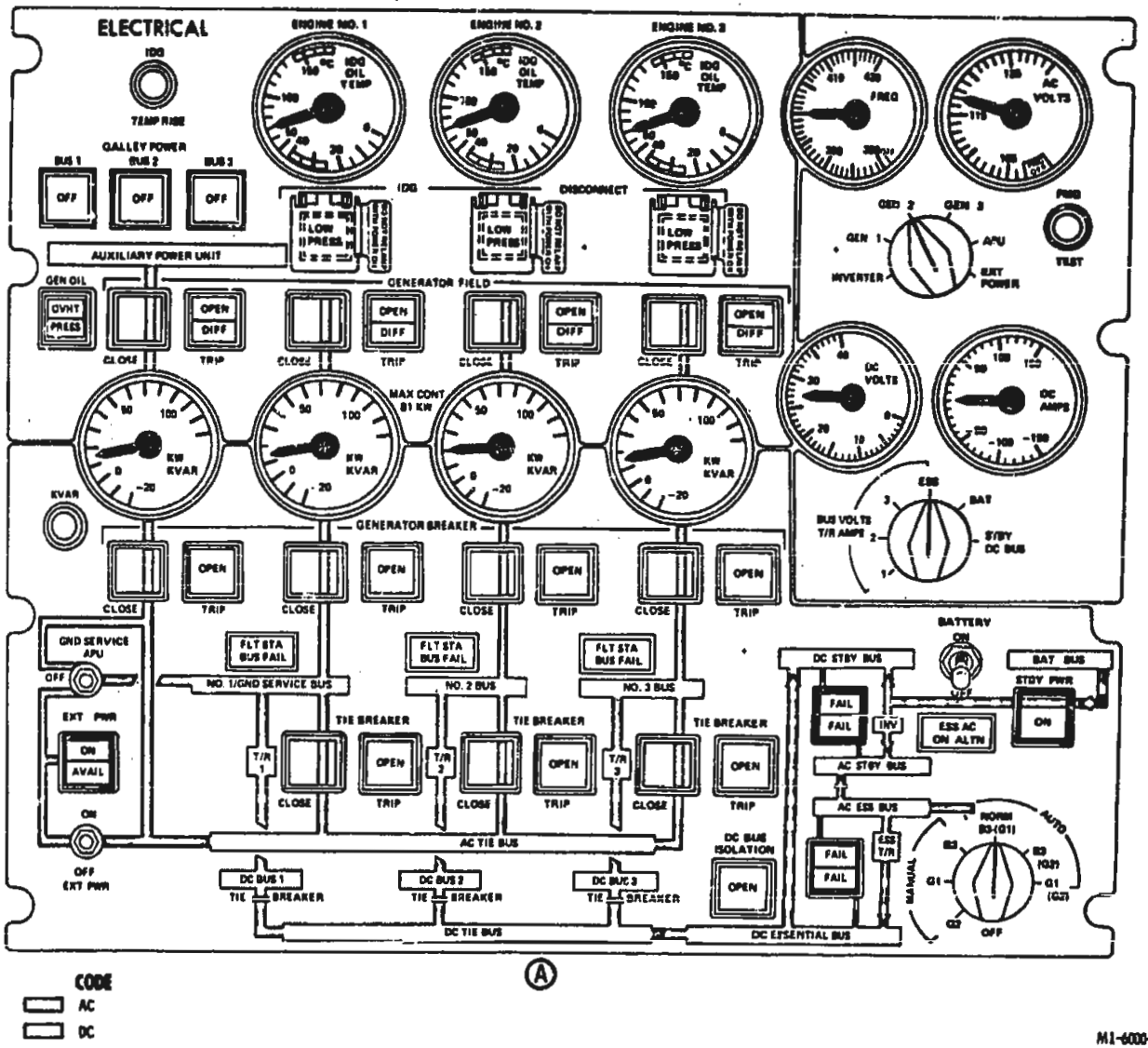
(7) Press TIE BREAKER TRIP switchlight and verify the following: the Tie BREAKER TRIP OPEN switchlight comes on and the CLOSE (light bar) switchlight goes off.

(8) Press the TIE BREAKER CLOSE switchlight and check for close indication (light bar comes on) and for tie breaker trip switchlight OPEN light to go off.

(9) If not otherwise in use, turn off aircraft electrical system (Ref. 24-41-00).

(10) Close all access doors.





M1-6000-24-096

R Flight Engineer/Second Officers Electrical Control Panel
R Figure 402

EFFECTIVITY: ALL

0018

APU GENERATOR SYSTEM - DESCRIPTION AND OPERATION

1. General

The APU generator system consists of the APU generator assembly, a generator control unit (GCU), a generator control current transformer, a differential protection current transformer, and a generator breaker (GB). A kW/kvar meter is provided for the system, and an ac voltmeter and frequency meter are shared with the engine-driven generator system.

The GCU provides control and protection for the system. The system receives signals from the generator assembly, the generator control current transformer, the differential protection circuit, the other GCU, and the external power circuit to automatically control the generator output. Manual switches on the Flight Engineer/Second Officers electrical control panel, zone 215, provide on, off, and reset functions. The GCU controls the generator voltage and the GB to connect the output to the bus system.

To eliminate an undesirable transient in generator output that can occur before APU operation has stabilized, a generator field trip time delay relay (2499-K15) is incorporated in the APU
R generator controlcircuit (Ref. Fig. 1).

During an APU start, the time delay relay has 28vdc energization voltage applied at terminal X1 which is rectified APU generator PMG voltage from the APU GCU. A 28V dc control voltage applied through the deenergized K1 relay in the APU electronic control unit and the relaxed APU generator breaker (2421-K1) is applied to terminal C1 and enables energization of the time delay relay. The K1 relay also makes a ground which is applied to pin 31 of the GCU preventing the GCU from pulling in the APU generator breaker and putting the generator on the line. With the time delay relay energized, an alternate GCU ground is made through contacts A1-A2 of the relay. Rectified PMG voltage applied through contacts B1-B2 turns on the DONT LOAD light on the APU CONTROL panel.

When APU free turbine speed reaches 95% N2 the K1 relay is energized. This removes the GCU ground in the electronic control unit and the 28V dc time delay relay control voltage. The APU generator is now kept off the line by the ground created through the time delay relay. With the control voltage removed the time delay relay begins to time out. The 5 to 7 seconds taken by the relay to relax provides time for APU operation to stabilize before the generator load is applied to the APU.

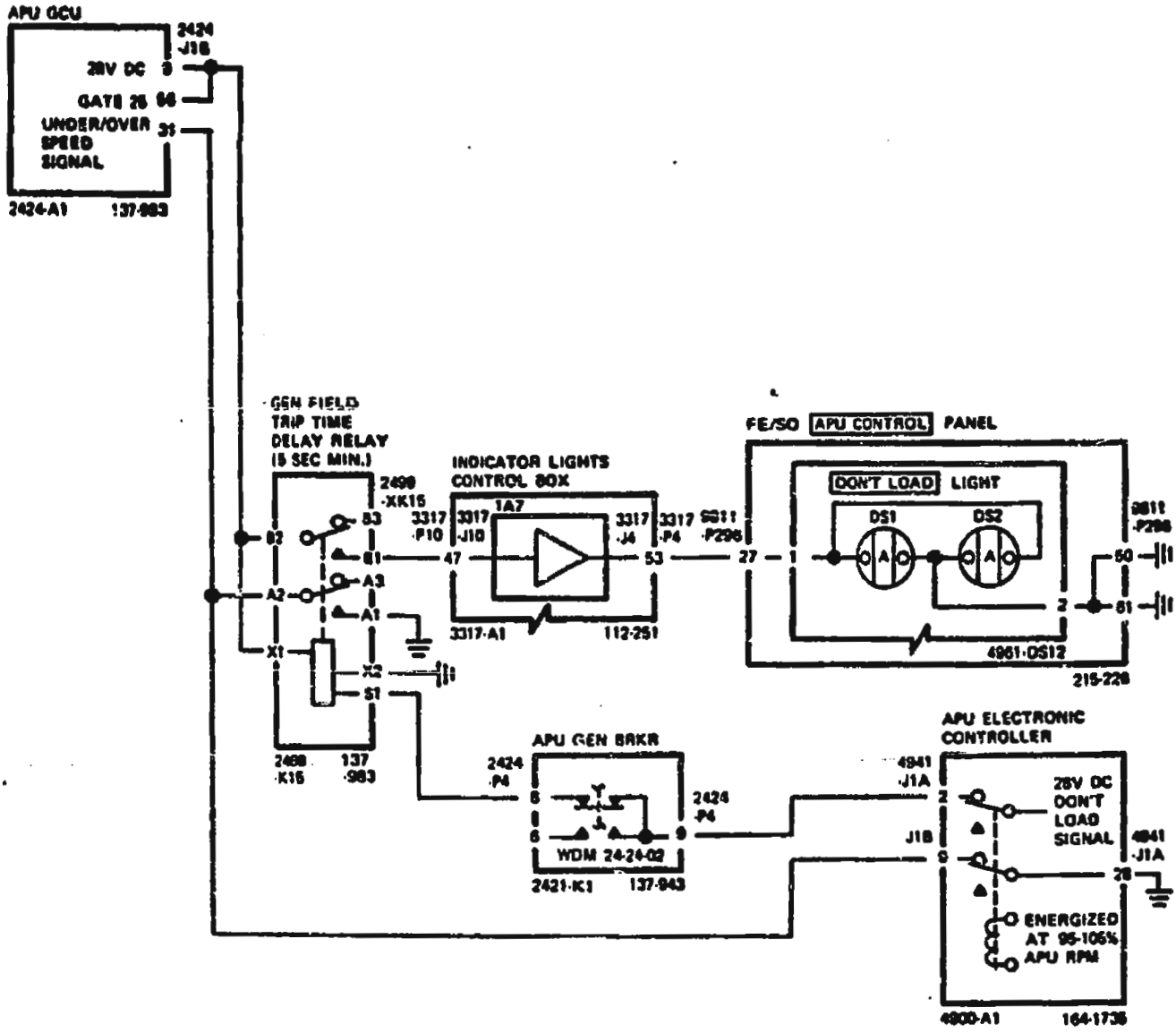
When the time delay relay relaxes, the ground is removed from the GCU and the GCU pulls in the generator breaker and puts the generator on the line. The PMG voltage to the DONT LOAD light is simultaneously removed and the light goes out. The time delay relay remains relaxed until the K1 relay is once again deenergized and 28V dc control voltage is applied to terminal C1. This occurs whenever N2 (free turbine speed) drops below 95% N2 (as in a normal APU shutdown) or an N2 overspeed condition of 105% is sensed by the NfB free turbine speed sensor.

The operation of the complete generation system is described in 24-00-00.

R 2. APU Generator Assembly

A. Description

The APU generator assembly consists of the APU generator adapter (Ref. 24-14-00) mated to a generator (Ref. 24-21-00). The APU generator assembly is not split at the flight line level, but is always removed and installed as a complete unit.



EM1-0100-24-507

APU Generator Breaker Close Circuit Schematic
Figure 1

APU GENERATOR SYSTEM - MAINTENANCE PRACTICES

1. Referenced Procedure

49-00-01 Auxiliary Power Unit (APU) - Adjustment and Test

2. Maintenance Practices

R WARNING: BEFORE ENERGIZING ELECTRICAL SYSTEM, VERIFY THAT ALL CONCERNED PERSONNEL ARE NOTIFIED. HIGH VOLTAGE CAN BE FATAL.

The following procedures cover the application of APU generator power to the aircraft.

These procedures assume that all systems are operating normally. If any system fails to operate as indicated, refer to the applicable fault isolation procedures.

A. Apply Power to All Buses

R (1) On pilots overhead circuit breaker panel CB1, zone 210,
R verify that the following circuit breakers are closed:

R STANDBY DC - CONT and PWR (B12 and B13)

R ENGINE START PWR (B15)

R AIR OVBD (J14)

R AC STBY BUS SENSE (K10)

R AC ESS BUS CONT (K11)

R ENGINE START BUS IND (K12)

R DC STBY IND (K13)

R GEN CONTROL UNITS - GEN 1, 2, and 3 (K15, K16, and K17)

R On Flight Engineer/Second Officers overhead circuit
R breaker panel CB2, zone 215, verify that circuit
R breakers IND LT - F/E PANEL - LOWER (J4) and BAT CHG
R INTLK (L6) are closed.

R On Flight Engineer/Second Officers aft circuit breaker
R panel CB3, zone 215, verify that the following circuit
R breakers are closed:

R TIE BUS CONT - BUS 1, BUS 2, and BUS 3 (A9, A10,
R and A11)

R TIE BUS PWR - BUS 1, BUS 2, and BUS 3 (A12, A13,
R and A14)

R BAT CHG (A15)

R BUS 3 GALLEY PWR (A16)

R GND SVCE GALLEY EXT (A17)

R APU T/R PWR (B11)

R APU GEN CONT UNIT (B17)

R LOAD CONT & FAIL IND - BUS 1, BUS 2, and BUS 3
R (D10, D13, and D16)

R FLIGHT STA PWR - BUS 1, 2, and 3 (E9, E10, and
R E11)

R ESS PWR - GEN 1, 2, and BUS 3 (E12, E13, and E14)

R T/R PWR - 1, 2, and 3 (E16, E17, and E18)

R DC STBY PWR (F1)

R DC TIE BUS - CONT and PWR (F2 and F3)

R ENG START PWR (F10)

R AC STBY BUS PWR (F12)

R BUS SENSING AC BUS (F14)

R ESS T/R PWR (F17)

R AC BUS IND (G11)

R DC AUTO XFR (G13)

R GEN OVERLOAD PROTECT (G14)

R IDG DISC (G15)

R ELECTRIC METER SWITCH (G16)

R PASS SVCE - BUS 1 - L and R (Z9 and Z10)

R FWD AC GND SVCE BUS (Z11)

PASS SVCE - BUS 2 and BUS 3 (Z15 and Z16)

IDG OIL - LOW PRESS and TEMP (AA17 and AA18)

On galley left circuit breaker panel, zone 130, verify that circuit breaker PNL - BUS PROTECT is closed.

On front of each generator control unit and on the bus protection panel, zone 137, verify that circuit breakers CB1 and CB2 are closed.

(2) Start APU (Ref. 49-00-01).

NOTE: When external power is not energizing buses, the APU generator will automatically energize buses when it reaches operating speed.

When external power is energizing buses, place EXT PWR switch on Flight Engineer/Second Officers electrical control panel, zone 215, in the OFF position; the APU generator will take over buses.

When any engine-driven generators are energizing buses, the APU generator will normally parallel.

(3) If the APU generator does not automatically operate as noted above, perform the following steps:

NOTE: All controls and indicators are located on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215.

(a) Verify that light bar on APU GENERATOR FIELD CLOSE switchlight is on. If not, press switchlight.

(b) Verify that light bar on APU GENERATOR BREAKER CLOSE switchlight is on. If not, press and release the following switchlights in order listed:

GENERATOR FIELD TRIP

GENERATOR BREAKER CLOSE

GENERATOR FIELD CLOSE

B. Activate the Ground Service System

(1) Apply APU generator power to all buses (Step 2 A).

(2) Activate ground service system by placing GND SERVICE switch on Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, in the APU position.

C. Deactivate the Ground Service System

Deactivate the system using either Step (1) or (2):

(1) Place GND SERVICE switch on Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, in OFF position.

(2) Shut down APU (Ref. 49-00-01).

D. Remove APU Power from All Buses

(1) Shut down APU if not needed for other purposes (Ref 49-00-01).

(2) If APU is needed for other purposes, press APU GENERATOR FIELD TRIP switchlight. Generator will be deenergized and generator breaker will automatically trip.

NOTE: To restore APU generator power to buses press GENERATOR FIELD CLOSE switchlight.

APU GENERATOR ASSEMBLY - SERVICING

1. Equipment and Materials

Container (5 quarts, minimum)

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

R Lubricant, Acryloid, HF825, or equivalent

O-rings and filter element (Ref. Fig. 301)

Drain Hose, Technical Development Co, PN DB-734N or DB-734NL, or equivalent

2. Referenced Procedures

	12-12-51	Auxiliary Power Unit Generator Assembly - Oil Replenishing
R	24-24-01	APU Generator Assemmbly - Inspection and Check
	24-14-02	APU Adapter Oil Filter Element - Removal and Installation
	49-00-01	Auxiliary Power Unit - Adjustment and Test

3. Servicing

A. To Drain Oil System

(1) Open access doors 319AL and 319CL on left side of APU compartment.

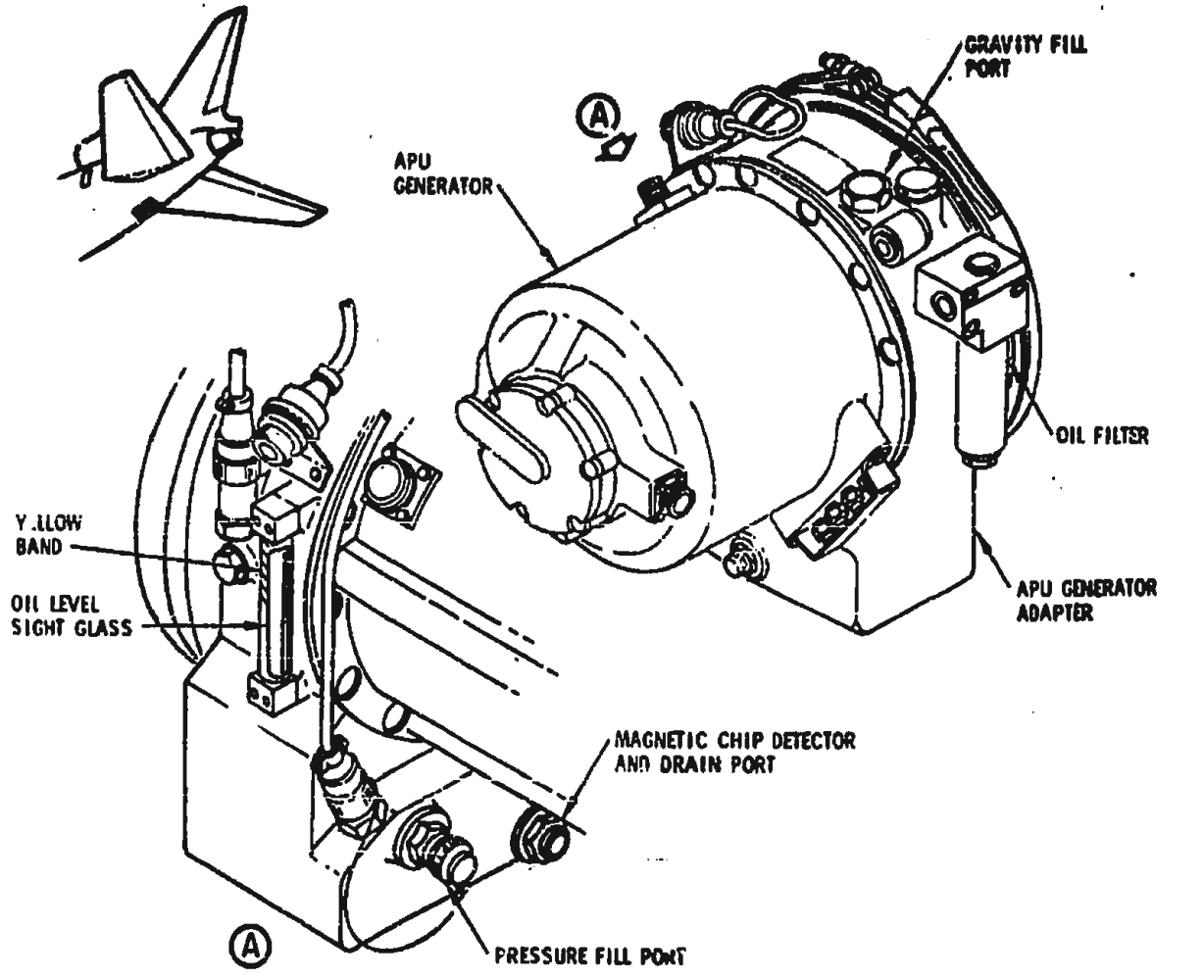
(2) Loosen gravity fill plug (Ref. Fig. 301).

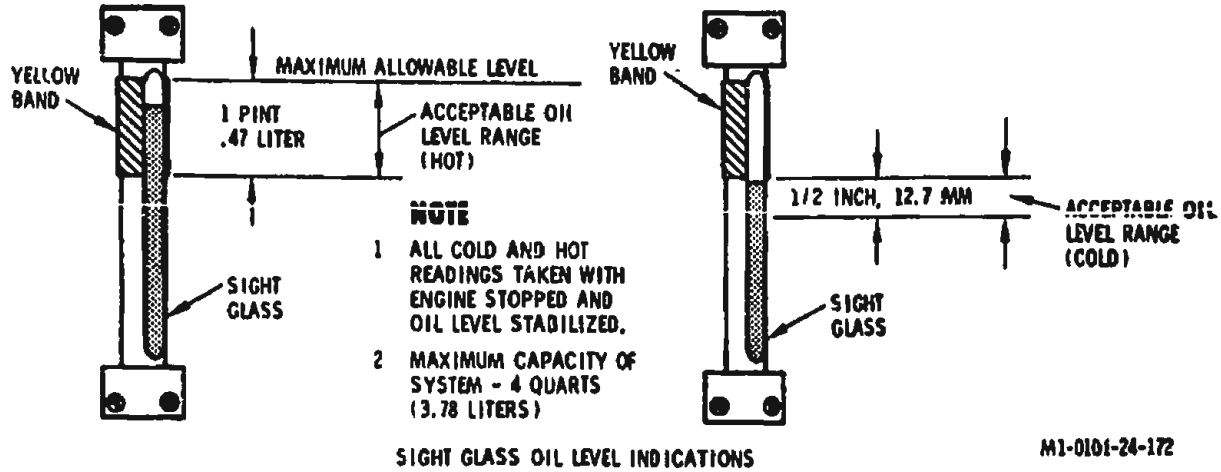
(3) Position container under adapter and remove the filter bowl and element (Ref. 24-14-02).

(4) Remove magnetic chip detector; insert drain hose fitting into drain plug to open orifice and drain oil.

(5) Inspect magnetic chip detector and filter element (Ref. 24-24-01).

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT ON ALL O-RINGS




YELLOW BAND
MAXIMUM ALLOWABLE LEVEL
1 PINT .47 LITER
ACCEPTABLE OIL LEVEL RANGE (HOT)
SIGHT GLASS
NOTE
1 ALL COLD AND HOT READINGS TAKEN WITH ENGINE STOPPED AND OIL LEVEL STABILIZED.
2 MAXIMUM CAPACITY OF SYSTEM - 4 QUARTS (3.78 LITERS)
YELLOW BAND
1/2 INCH, 12.7 MM
ACCEPTABLE OIL LEVEL RANGE (COLD)
SIGHT GLASS

SIGHT GLASS OIL LEVEL INDICATIONS

M1-0101-24-172

Servicing Points on APU Generator Assembly
Figure 301

(6) Install magnetic chip detector using new lubricated O-ring. Torque chip detector 35 to 45 lb in.

(7) Install new filter element as required using new lubricated O-rings (Ref. 24-14-02).

(8) Tighten gravity fill plug. Torque 20 to 30 lb in. and install lock-wire.

(9) Fill oil system (Ref. 12-12-51).

(10) Close and secure access doors.

APU GENERATOR ASSEMBLY - REMOVAL AND INSTALLATION

1. Equipment and Materials

APU Generator Removal Sling PN B989, or equivalent

Cover set, generator drive and pad

O-rings (Ref. Fig. 401, sheet 2)

R Lubricant, Acryloid, HF825, or equivalent

Container (5 quarts, minimum)

2. Referenced Procedures

24-24-01	APU Generator Assembly - Servicing
49-00-01	Auxiliary Power Unit (APU) - Adjustment and Test
49-91-01	Oil/Air Heat Exchanger - Removal/Installation

3. Removal/Installation

A. Removal

CAUTION: THE APU GENERATOR MUST BE REMOVED AS A COMPLETE ASSEMBLY ONLY. REMOVAL AND INSTALLATION OF COMPONENT PARTS FROM THE APU ON THE AIRCRAFT EXCEPT AS SPECIFIED BY THIS MAINTENANCE MANUAL CAN RESULT IN DAMAGE TO THE APU GENERATOR AND CONTAMINATION OF THE OIL COOLER.

(1) On the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag the following circuit breakers:

APU POWER - BAT PWR (B10)

APU POWER - CONTROLLER - BUS 2 (B13)

APU POWER - CONTROLLER - GND BUS (B14)

APU POWER - CONTROL & PRI FW SOV - GND BUS (B15)

APU POWER - CONTROL & PRI FW SOV - BUS 2 (B16)

APU POWER - APU GEN CONT UNIT (B17)

APU POWER - APU T/R PWR (B11)

(2) Open APU compartment access doors 319 AL and 319 CL on left side of compartment.

(3) Tag and remove the main generator leads.

(4) Disconnect the two generator electrical connectors and one adapter electrical connector.

(5) Drain oil into container.

(6) Disconnect and cap the cooling oil lines.

(7) Attach sling shackle to hard point in ceiling of APU compartment above generator.

(8) Position sling frame on generator and screw two rods snugly onto the elongated studs (Ref. Fig. 401).

(9) Install plate on ends of rods and secure with nuts. Tighten nuts enough to prevent frame from shifting on generator.

CAUTION: DO NOT PERMIT GENERATOR ASSEMBLY TO HANG ON SPLINE SHAFT. GENERATOR AND ADAPTER WEIGH APPROXIMATELY 80.75 POUNDS DRY.

(10) Support weight of generator and adapter with sling and release V-band clamp.

(11) Move assembly straight outboard to clear spline shaft, rotate 90 degrees to clear surrounding equipment, and lower to work platform.

(12) Remove and discard o-rings.

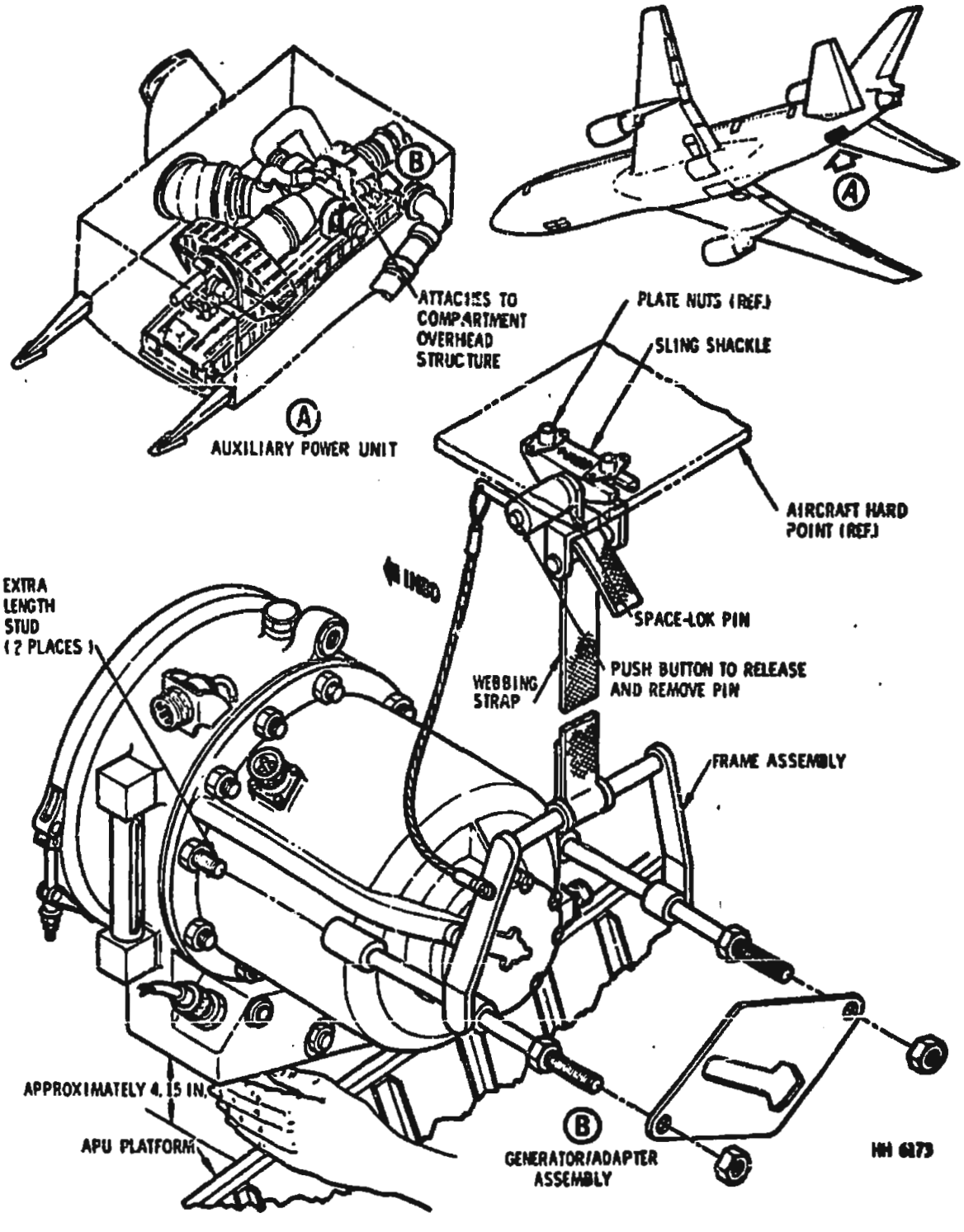
(13) Install protective covers on assembly and on APU mount pad.

B. Installation

(1) Verify that circuit breakers opened in Step 3A(1) are open and tagged.

CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL O-RINGS.

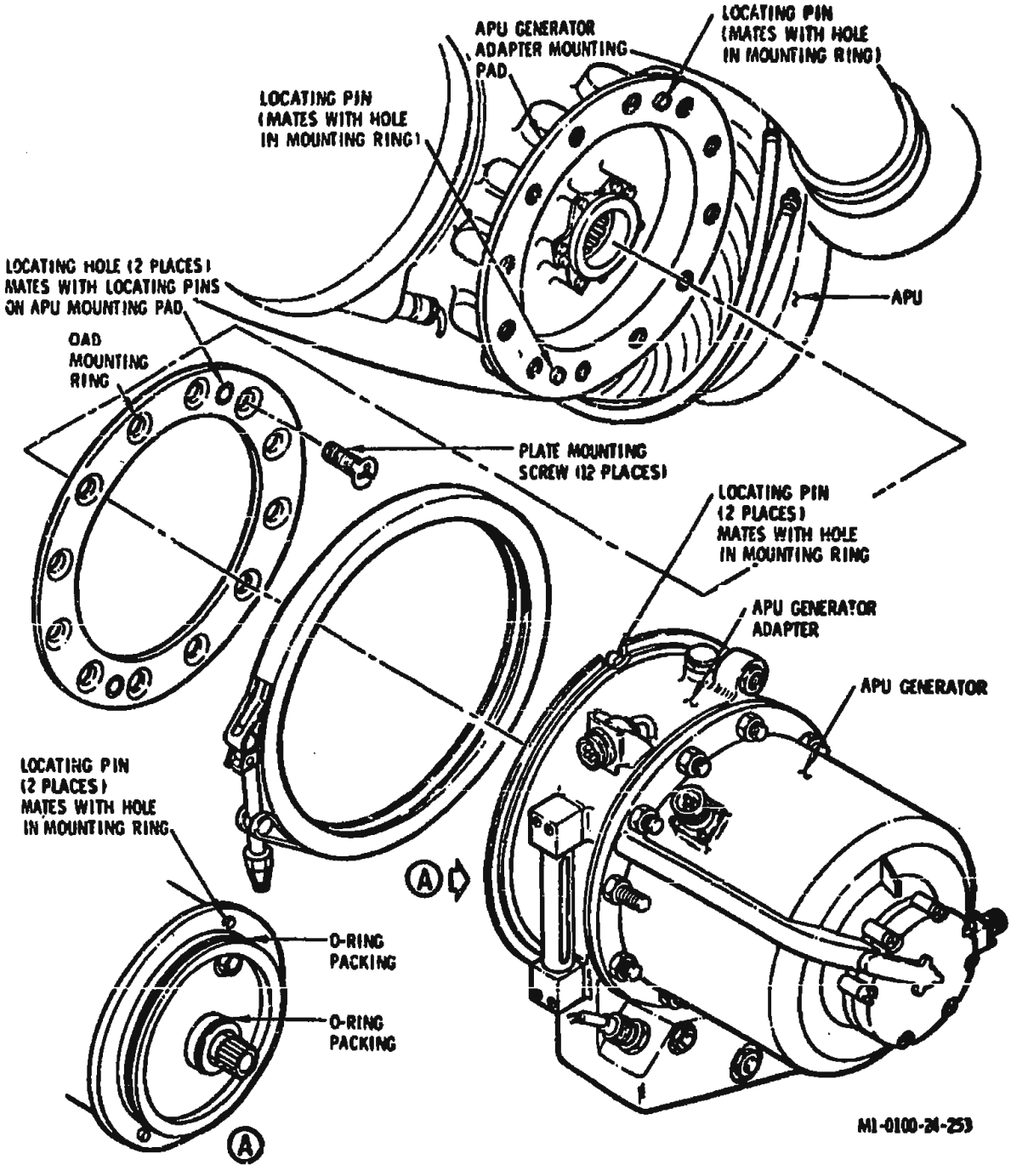
VERIFY THAT O-RING PACKINGS ARE NOT STRETCHED OR DAMAGED DURING UNPACKAGING OR INSTALLATION.



R APU Generator Assembly - Removal and Installation
R Figure 401 (Sheet 1)

EFFECTIVITY: ALL

001E


APU GENERATOR ADAPTER MOUNTING PAD
LOCATING PIN (MATES WITH HOLE IN MOUNTING RING)
LOCATING PIN (MATES WITH HOLE IN MOUNTING RING)
LOCATING HOLE (2 PLACES) MATES WITH LOCATING PINS ON APU MOUNTING PAD
APU
OAD MOUNTING RING
PLATE MOUNTING SCREW (12 PLACES)
LOCATING PIN (2 PLACES) MATES WITH HOLE IN MOUNTING RING
APU GENERATOR ADAPTER
APU GENERATOR
LOCATING PIN (2 PLACES) MATES WITH HOLE IN MOUNTING RING
O-RING PACKING
O-RING PACKING
A
A
M1-0100-24-253

R APU Generator Assembly - Removal and Installation
R Figure 401 (Sheet 2)

(2) Install new lubricated o-ring packings in grooves provided (Ref. Fig. 401, Sheet 2).

(3) Position APU generator assembly on work stand below sling hard point in ceiling of APU compartment, Attach sling shackle to hard point and attach sling frame to generator assembly.

(4) Remove protective covers from APU mount pad and generator assembly.

CAUTION: DO NOT BUMP GENERATOR ASSEMBLY SPLINE SHAFT OR ALLOW GENERATOR ASSEMBLY WEIGHT TO HANG ON SPLINE SHAFT.

NOTE: If QAD mounting ring is not installed on APU, install ring exactly as shown in Figure 401, Sheet 2. Verify that both dowel pins on APU mounting pad mate with holes in mounting ring.

CAUTION: VERIFY THAT O-RING PACKINGS ARE CORRECTLY INSTALLED IN GROOVES PROVIDED BEFORE INSTALLING GENERATOR ASSEMBLY (Ref. detail A, Fig. 401, sheet 2).

(5) Hoist generator assembly into position and align spline shaft with APU drive spline.

(6) Verify that locating dowel pins on generator adapter align with mating holes in QAD mounting ring, and push generator assembly into position.

CAUTION: APU GENERATOR LOCATING DOWEL PINS CAN BE IMPROPERLY ALIGNED WITH THE COUNTERSUNK SCREW HOLES ON THE QAD MOUNTING RING. THIS RESULTS IN THE APU GENERATOR BEING ROTATED 15° COUNTERCLOCKWISE FROM THE CORRECT POSITION. WHEN LOCATING DOWEL PINS ARE IN THE PROPER LOCATING HOLE, THE LEFT END OF THE APU GENERATOR OIL RESERVOIR IS APPROXIMATELY ONE HAND HIGH ABOVE THE APU PLATFORM (Ref. Fig. 401, Sheet 1). IF THE OIL RESERVOIR APPEARS TO BE NEARLY PARALLEL WITH THE APU PLATFORM, THE APU GENERATOR LOCATING DOWEL PINS ARE IMPROPERLY ALIGNED.

(7) Install V-band and torque tighten to between 90 and 100 inch pounds. Position of V-band clamp is optional, however the position shown in Figure 401 is recommended.

R NOTE: Lockwire tension bolt (Ref. Fig. 402).

(8) Remove sling frame from generator assembly and sling shackle from hard point.

(9) Connect and lock-wire generator connectors and adapter connector.

(10) Connect main generator leads. Torque 162 to 180 lb-in. Remove tags, and install terminal cover.

CAUTION: IF GENERATOR ASSEMBLY WAS REMOVED AS A RESULT OF A GENERATOR FAILURE, CHECK DIFFERENTIAL PRESSURE INDICATOR ON FILTER. IF INDICATOR BUTTON HAS POPPED OUT (RED BAND SHOWING), PERFORM STEP B(11).

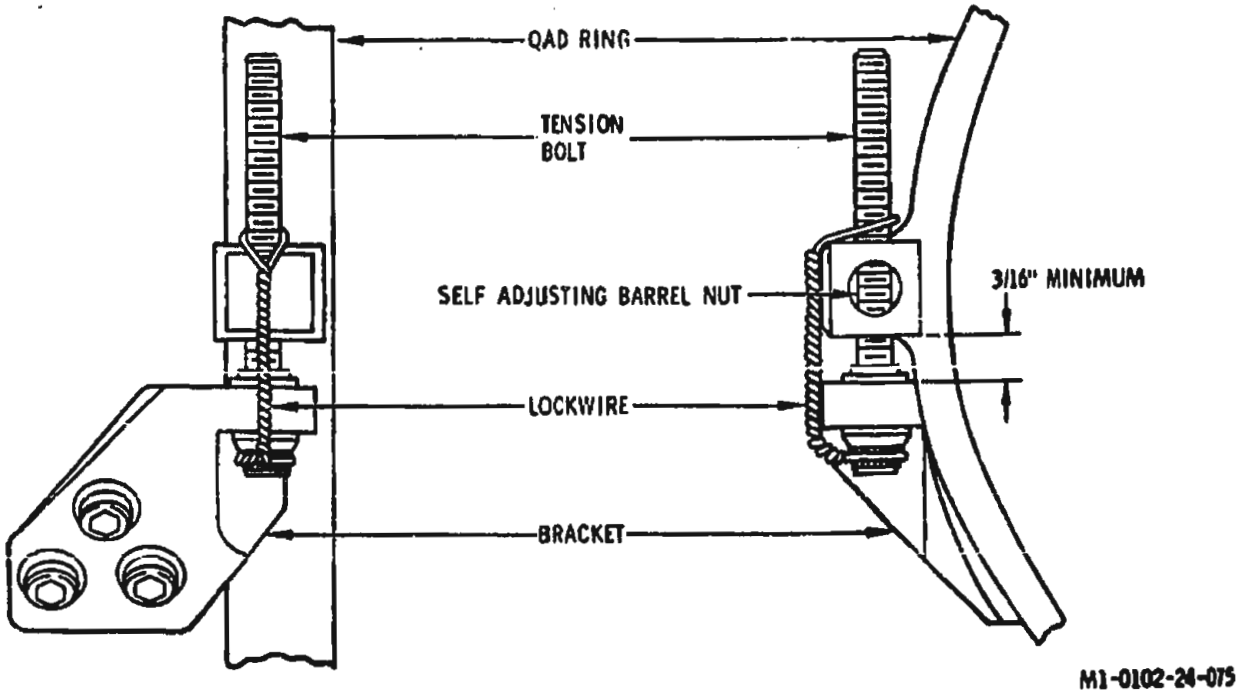
(11) Replace oil/air heat exchanger (Ref. 49-91-01).

R (12) Connect oil cooler lines (Ref. 49-91-01.

(13) Fill generator assembly with oil (Ref. 24-24-01).

(14) Remove tags and close circuit breakers opened in Step 3A(1).

(15) Start APU (Ref. 49-00-01).



Lock-wiring Tension Bolt
Figure 402

R (16) Verify that APU GEN OIL PRESS light goes off, voltage and frequency of APU generator output are normal, and no overheat occurs during run. Run APU a minimum of 5 minutes.

R (17) Stop APU and inspect generator installation for oil leaks (Ref. 49-00-01). Repair leaks and recheck.

R (18) Close and secure APU compartment access doors.

APU GENERATOR MAGNETIC PLUG - INSPECTION AND CHECK

1. Equipment and Materials

   Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

   Lubricant, Acryloid, or equivalent

   O-ring (Ref. Fig. 601)

2. Referenced Procedures

   24-24-01 APU Generator Assembly - Servicing

   24-24-01 APU Generator Assembly - Removal and Installation

3. Inspection/Check

   A. Magnetic Plug Check

      (1) Remove magnetic plug (Ref. Fig. 601).

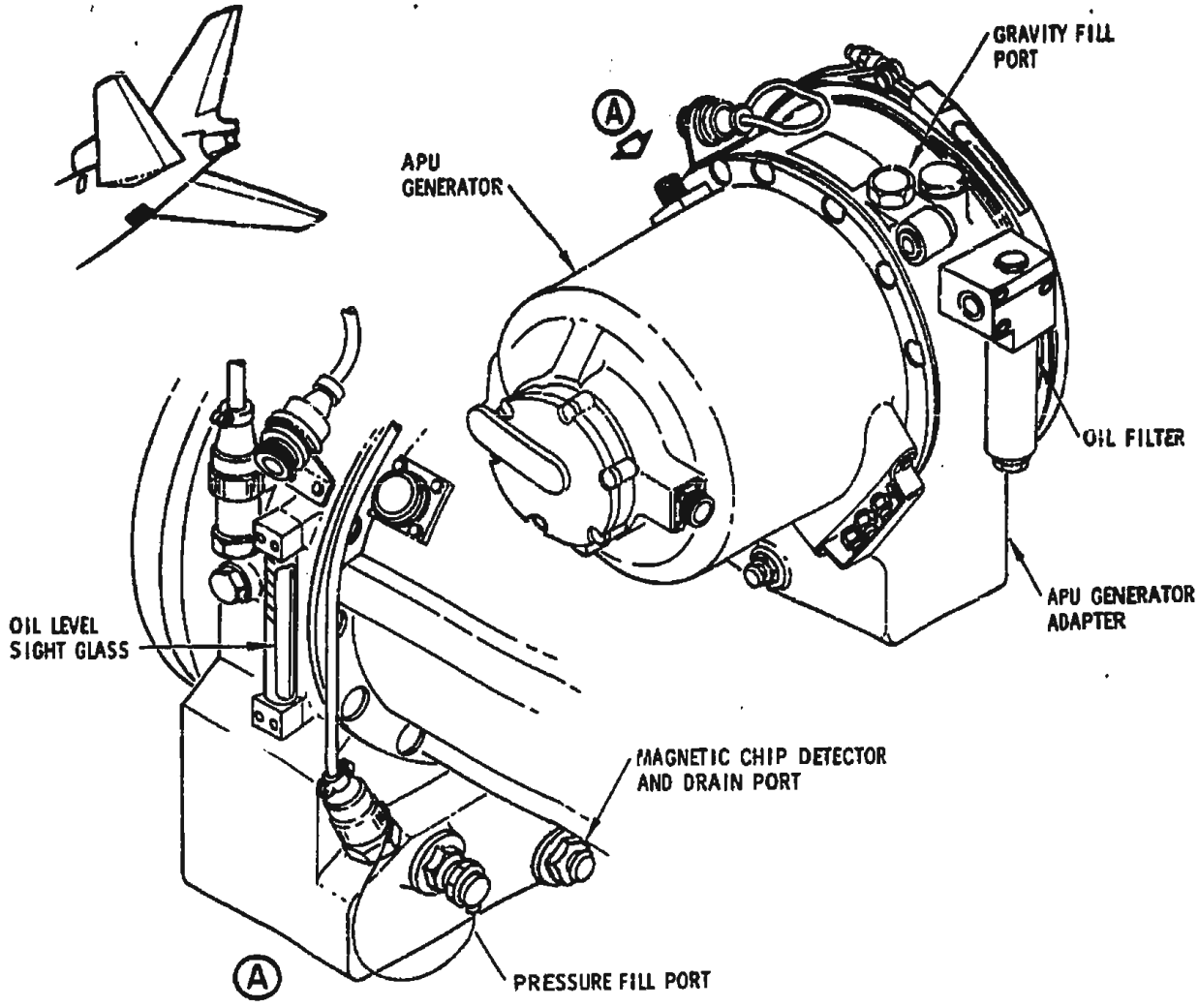
      (2) Inspect magnetic plug according to Figure 601

      CAUTION: ACRYLOID OR EQUIVALENT MUST BE USED AS A LUBRICANT TO INSTALL O-RINGS.

      VERIFY THAT O-RINGS ARE NOT STRETCHED OR DAMAGED DURING UNPACKAGING OR INSTALLATION.

      (3) Install new O-ring on magnetic plug using acryloid or equivalent for lubrication.

      (4) Install magnetic plug. Torque 15 to 20 lb-in and lock-wire.



NORMAL-SMALL AMOUNT OF FUZZ-CLEAN AND REPLACE

HEAVY DEPOSITS OF FUZZ-CLEAN, REPLACE, AND RECHECK AFTER TEST RUN

BRIGHT METAL CHIPS OR FLAKES-REMOVE AND REPLACE

M1-0001-24-1317

R APU Generator Magnetic Plug Inspection
R Figure 601

EFFECTIVITY: ALL

001B

APU GENERATOR BREAKER - MAINTENANCE PRACTICES

1. General

The following procedure applies when the generator breaker is inoperative for both auto and manual opening.

A. Deactivation

R NOTE: This deactivation procedure applies only when
R aircraft is to be dispatched in accordance with the
R MEL.

WARNING: REMOVE ALL ELECTRICAL POWER FROM AIRCRAFT BEFORE PERFORMING THIS PROCEDURE.

(1) On pilots center console, zone 210, verify that FUEL AND IGNITION switches are in the OFF position and tagged.

(2) On the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, verify that EXT PWR switch is in the OFF position and tagged.

(3) On the APU CONTROL panel, zone 215, verify that MASTER POWER switch is in the OFF position and tagged.

(4) Open access doors 192K and 137AZ and enter mid electrical service center, zone 137.

(5) Release CAMLOC fasteners and open applicable door of the ac power distribution box to gain access to breaker to be deactivated.

(6) Deactivate breaker by removing protective cover and manually opening main contacts of breaker.

(7) Reinstall protective cover, close ac power distribution box door and access doors 192K and 137AZ.

(8) Remove tags installed in Steps 1A(1) through 1A(3).

(9) On ELECTRICAL panel, place BATTERY switch in ON position, and press appropriate GENERATOR FIELD TRIP and GENERATOR BREAKER TRIP switchlights. Verify that OPEN indicator in each switchlight comes on. Place BATTERY switch in OFF position.

(10) Install tag on appropriate GENERATOR FIELD and BREAKER switchlights to prevent closure.

(11) Install placard on ELECTRICAL panel.

(12) Make appropriate entry in aircraft log book.

APU GENERATOR BREAKER - REMOVAL AND INSTALLATION

1. Referenced Procedures

R R	6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
R R	6-50-00	Interior Access Doors and Removable Panels - Description and Operation
	24-41-00	External Power/Ground Service System - Maintenance Practices
	49-00-01	Auxiliary Power Unit (APU) - Adjustment and Test

2. Removal/Installation

A. Removal

R R R (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breakers APU POWER CONTROL and IGNITION.

R R (2) On pilots center console, zone 210, ensure that FUEL AND IGNITION switches are in OFF position and tagged.

R (3) On Flight Engineer/Second Officers electrical control panel, zone 215, place EXT PWR switch in the OFF position and tag.

R R (4) Ensure that external power source (Ref. 24-41-00) is turned off.

(5) Remove external power plug from receptacle located on the lower fuselage just aft of the nosewheel well at FS 458, and tag receptacle.

R R (6) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

(7) Release Camloc fasteners and open APU door section of the ac power distribution box in mid electrical service center (Ref. Fig. 401).

WARNING: USE CAUTION IN THE AC POWER DISTRIBUTION BOX. VOLTAGES PRESENT CAN BE FATAL.

(8) Remove screws and protective cover from APU generator breaker (Ref. Fig. 401).

(9) Tag and remove wires from APU generator breaker terminal studs T1, T2, T3, L1, L2, and L3.

(10) Disengage electrical connector from APU generator breaker.

(11) Tag and remove screw and ground wire from APU generator breaker mounting flange.

(12) Remove remaining mounting screws and remove APU generator breaker from ac power distribution box.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Verify that control switches are properly positioned and tagged [Steps 2A(2) and 2A(3)].

(3) Position APU generator breaker (receptacle on left side) and secure with screws.

NOTE: Ground wire is secured with lower left screw.

(4) Engage electrical connector to receptacle on APU generator breaker.

(5) Reconnect tagged wires to proper terminal studs, remove tags and torque six 3/8 x 24 nuts 120 to 140 lb inches.

(6) Position protective cover and secure with screws.

(7) Close and secure APU door section of the ac power distribution box.

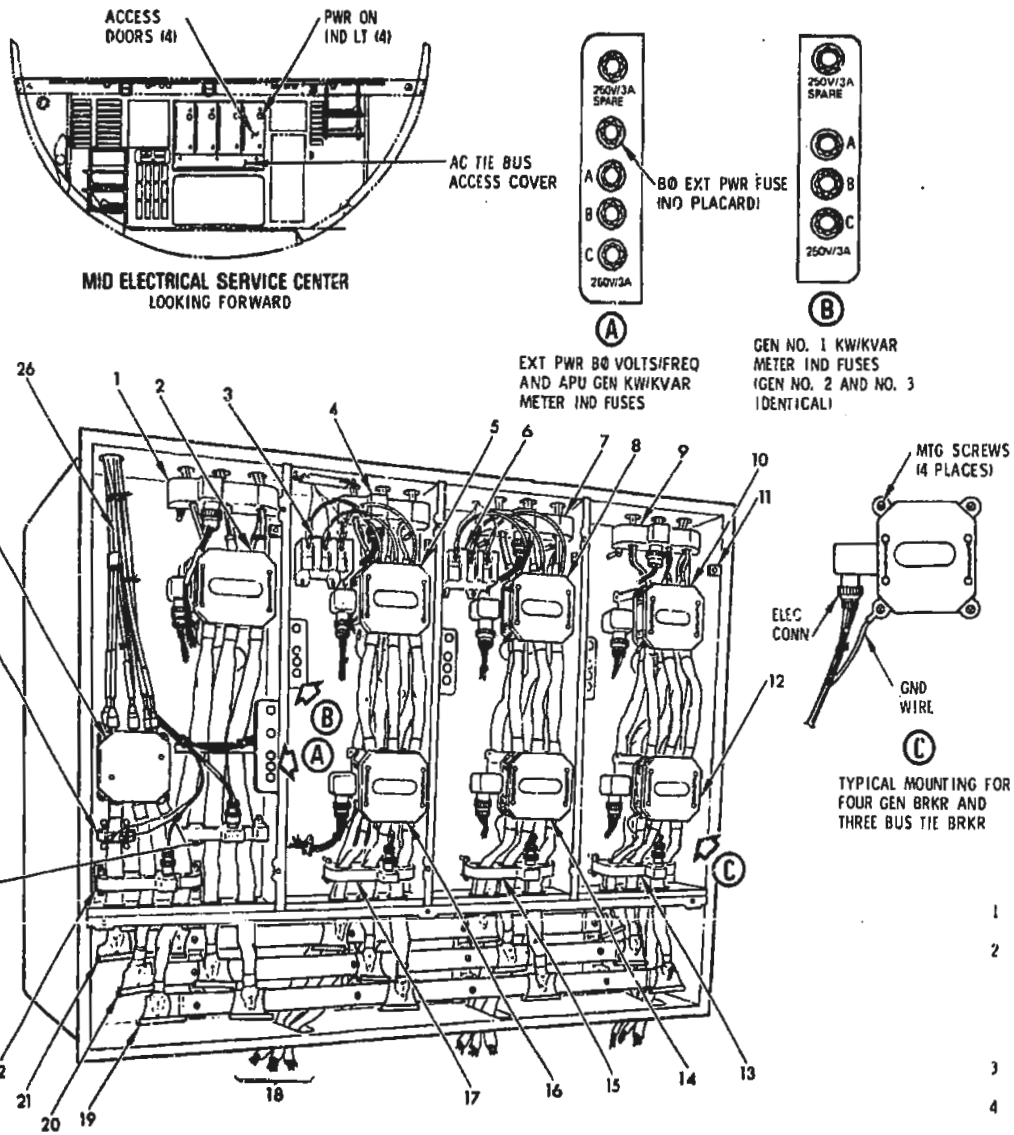
(8) Close and secure mid electrical service center ground access doors.

(9) Remove tag from external power receptacle.

(10) Remove tags from FUEL AND IGNITION switches (pilots center console) and EXT PWR switch (Flight Engineer/Second Officers electrical control panel).

(11) Remove tags and close circuit breakers opened in Step 2A(1).

WARNING: BEFORE STARTING APU, ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED. HIGH VOLTAGES CAN BE FATAL.



AC POWER SYSTEM DISTRIBUTION BOX COMPONENTS

ITEM NO.	NOMENCLATURE
1	APU GENERATOR CONTROL CURRENT TRANSFORMER
2	APU GENERATOR BREAKER
3	NO. 1 GENERATOR - AC ESSENTIAL BUS POWER RCCB
4	NO. 1 GENERATOR CONTROL CURRENT TRANSFORMER
5	NO. 1 GENERATOR BREAKER
6	NO. 2 GENERATOR - AC ESSENTIAL BUS POWER RCCB
7	NO. 2 GENERATOR CONTROL CURRENT TRANSFORMER
8	NO. 2 GENERATOR BREAKER
9	NO. 3 GENERATOR CONTROL CURRENT TRANSFORMER
10	NO. 3 GENERATOR BREAKER
11	POWER ON INDICATOR LIGHT (VISIBLE WITH DOOR CLOSED). TYPICAL FOR EACH OF THE FOUR POWER DISTRIBUTION PANELS
12	NO. 3 GENERATOR BUS TIE BREAKER
13	NO. 3 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
14	NO. 2 GENERATOR BUS TIE BREAKER
15	NO. 2 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
16	NO. 1 GENERATOR BUS TIE BREAKER
17	NO. 1 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
18	30 FEEDER WIRES TO AC BUS NO. 1. TYPICAL OF FEEDER WIRES TO AC BUS NO. 2 AND AC BUS NO. 3 FROM RESPECTIVE GENERATOR BREAKER
19	AC TIE BUS - C0 BUS
20	AC TIE BUS - B0 BUS
21	AC TIE BUS - A0 BUS
22	EXTERNAL POWER DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
23	APU GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
24	EXTERNAL POWER OVERCURRENT CURRENT TRANSFORMER - A0
25	EXTERNAL POWER RELAY
26	EXTERNAL POWER FEEDER WIRES

WARNING

DEENERGIZE ALL GENERATORS AND DISCONNECT EXTERNAL POWER AS OUTLINED IN SECTION 24-00-00 PRIOR TO PERFORMING ANY REMOVAL / INSTALLATION PROCEDURES IN THE AC DISTRIBUTION BOX OR AC TIE BUS COMPARTMENT

NOTE

1. AC POWER DISTRIBUTION BOX DOORS AND AC TIE BUS COVER PANEL NOT SHOWN
2. POWER DISTRIBUTION PANELS ARE IDENTIFIED FROM LEFT TO RIGHT AS FOLLOWS:
   A. EXTERNAL POWER AND APU GENERATOR PANEL
   B. GENERATOR NO. 1 PANEL
   C. GENERATOR NO. 2 PANEL
   D. GENERATOR NO. 3 PANEL
3. BUS TIE BREAKERS REQUIRE MICARTA SPACERS TO ACCOMMODATE FLAT BUS FEEDERS
4. INSTALL SAFETY WIRE ON ALL BREAKER COVER SCREWS

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R R **APU Generator Breaker - Removal and Installation**
Figure 401

(12) Start APU (Ref. 49-00-01).

(13) Perform the following checkout procedure to determine that APU generator breaker is operating correctly. All R controls and indicators are located on Flight Engineer/Second Officers electrical control panel, zone 215 (Ref. Fig. 402).

(a) Press GENERATOR FIELD CLOSE (APU) switchlight and check that close indication (light bar) comes on, and that GENERATOR BREAKER CLOSE (APU) switchlight indicates closed (light bar comes on).

(b) Check that at least one TIE BREAKER switchlight indicates closed (light bar on). If none is on, press one TIE BREAKER CLOSE switchlight and check that close indication (light bar) comes on.

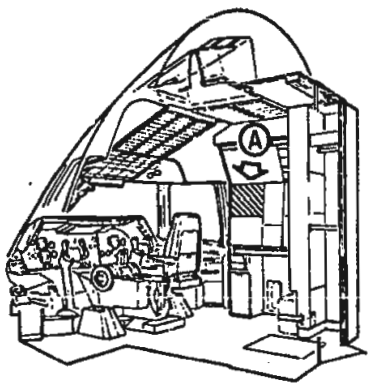
(c) Check for positive deflection on KW-KVAR meter (KW-KVAR meter reading depends on load being applied).

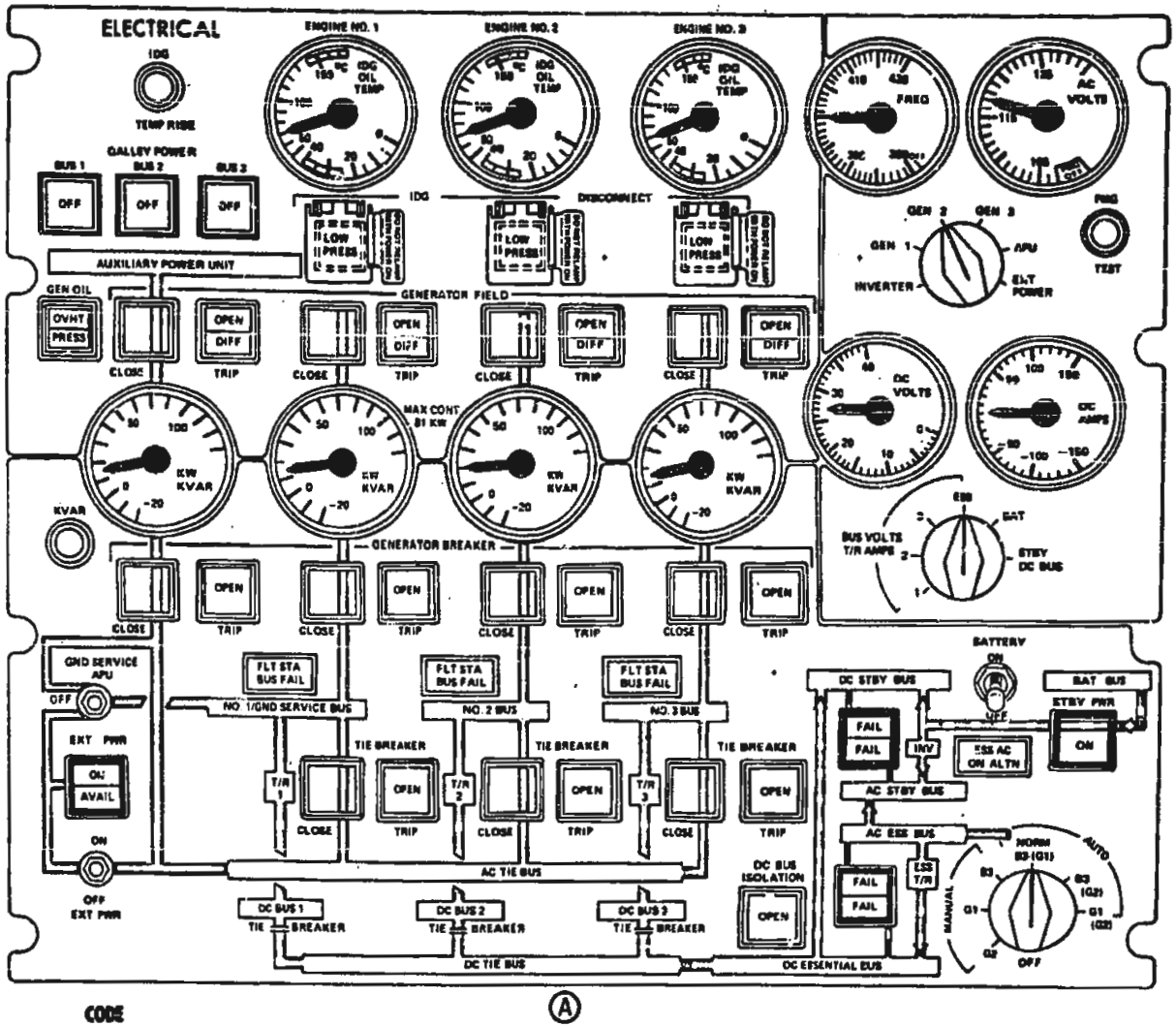
(d) Press GENERATOR BREAKER TRIP (APU) switchlight, and check that close indication (light bar) goes off and TRIP switchlight OPEN indication comes on.

(e) Press GENERATOR BREAKER CLOSE (APU) switchlight, and check for close indication (light bar) to come on and for TRIP switchlight OPEN indication to go off.

(f) Press GENERATOR FIELD TRIP (APU) switchlight. Check that GENERATOR FIELD CLOSE and GENERATOR BREAKER CLOSE switchlights indicate open (light bar goes off), and that GENERATOR FIELD TRIP and GENERATOR BREAKER TRIP switchlights come on indicating OPEN.

(g) If APU power is not needed, shut down APU (Ref. 49-00-01).





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R Flight Engineer/Second Officers Electrical Control Panel
R Figure 402

EFFECTIVITY: ALL

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DC GENERATION - DESCRIPTION AND OPERATION

1. General

All dc power is normally supplied by four 75-ampere transformer-rectifiers (TR). Each TR receives three-phase power from the ac system, converts it to a nominal 28 volts dc and supplies power to a dc bus system. The TR units normally operate in parallel, but isolation circuitry and controls for nonparallel operation are provided. Total dc load is less than the capacity of two TR units. The aircraft can be dispatched with one TR inoperative.

R A secondary (standby) dc power source consists of a 22-cell, 53 ampere-hour, nickel-cadmium battery. The battery is used to start the APU, energize the static inverter when needed, and to energize the dc portion of the standby power system (Ref. 24-32-00) when normal dc sources are not available.

DC POWER SYSTEM - DESCRIPTION AND OPERATION

1. General

The dc power system consists of components and circuitry located in the mid electrical service center, zone 137; the forward electronic service center, zone 112; the aft electronic equipment area, zone 164; and the flight station, zone 210. The components include: remotely controlled and push-pull circuit breakers, transformer-rectifiers, diodes, relays, switchlights, toggle and rotary switches, indicator lights, meters, and buses.

The system receives three-phase ac power from the primary system, converts it to a nominal 28V dc, and energizes a normally paralleled dc bus system through blocking diodes, circuit breakers, and tie breakers. The bus paralleling system is controlled by a DC BUS ISOLATION switchlight on the Flight Engineer/Second Officers electrical control panel, zone 215, (Ref. Fig. 1). The system is automatically energized whenever the ac system is energized, whether from external power, engine-driven generator(s), or from the APU-driven generator.

A BUS VOLTS T/R AMPS rotary selector switch and a dc voltmeter and ammeter, all located on the electrical control panel, provide source selection for indication of system operation. Malfunctions are indicated by lights on this panel and on the center instrument panel, zone 210.

Direct current is distributed by using a two-wire distribution system, with the aircraft structure serving as the second (or ground) wire. Distribution points are the flight station, zone 210; the aft electronic equipment area, zone 164; and the galley, zone 131. Circuit breakers and fuses located in the main distribution areas provide circuit protection where necessary.

2. Operation

Operation of the dc power system is basically automatic (Ref. Fig. 2). Transformer-rectifier No. 1 (TR-1) energizes the flight station dc ground service bus and, through contacts of the deenergized dc ground service relay, dc bus 1. Whenever the relay is energized, as in the ground service mode (Ref. 24-41-00), dc bus 1 is isolated and deenergized. In this condition, only the flight station dc ground service bus and its galley extension are energized. Direct-current bus 1 is normally tied to the dc tie bus through its associated TIE BUS PWR circuit breaker on the Flight Engineer/Second Officers circuit breaker panel CB3, zone 215, and its tie breaker.

Transformer-rectifiers (TR) No. 2 and No. 3 are similar in operation. Each TR energizes its associated bus (dc bus 2 or 3). Each dc bus is connected to the dc tie bus through its associated TIE BUS POWER circuit breaker on circuit breaker panel CB3 and through its dc tie breaker.

The essential TR energizes the dc essential bus. The dc essential bus is connected to the dc tie bus through the DC ESS BUS - DC TIE BUS PWR circuit breaker on circuit breaker panel CB3.

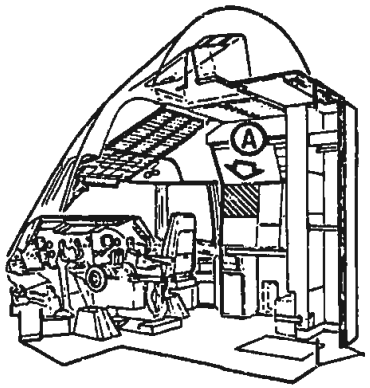
As stated, the dc buses are normally paralleled. The DC BUS ISOLATION switchlight is a push-on, push-off, four-pole, double-throw unit. When depressed (latched in), the switchlight opens the circuits to the dc tie breaker actuator coils. In this condition, the tie breakers are open, the buses are isolated from each other, and the OPEN indication of the switchlight is on. When the switchlight is released (out), the circuits are restored, the dc tie breakers parallel the buses, and the OPEN indication goes off. The dc bus paralleling switchlight is normally left in the closed (out) position.

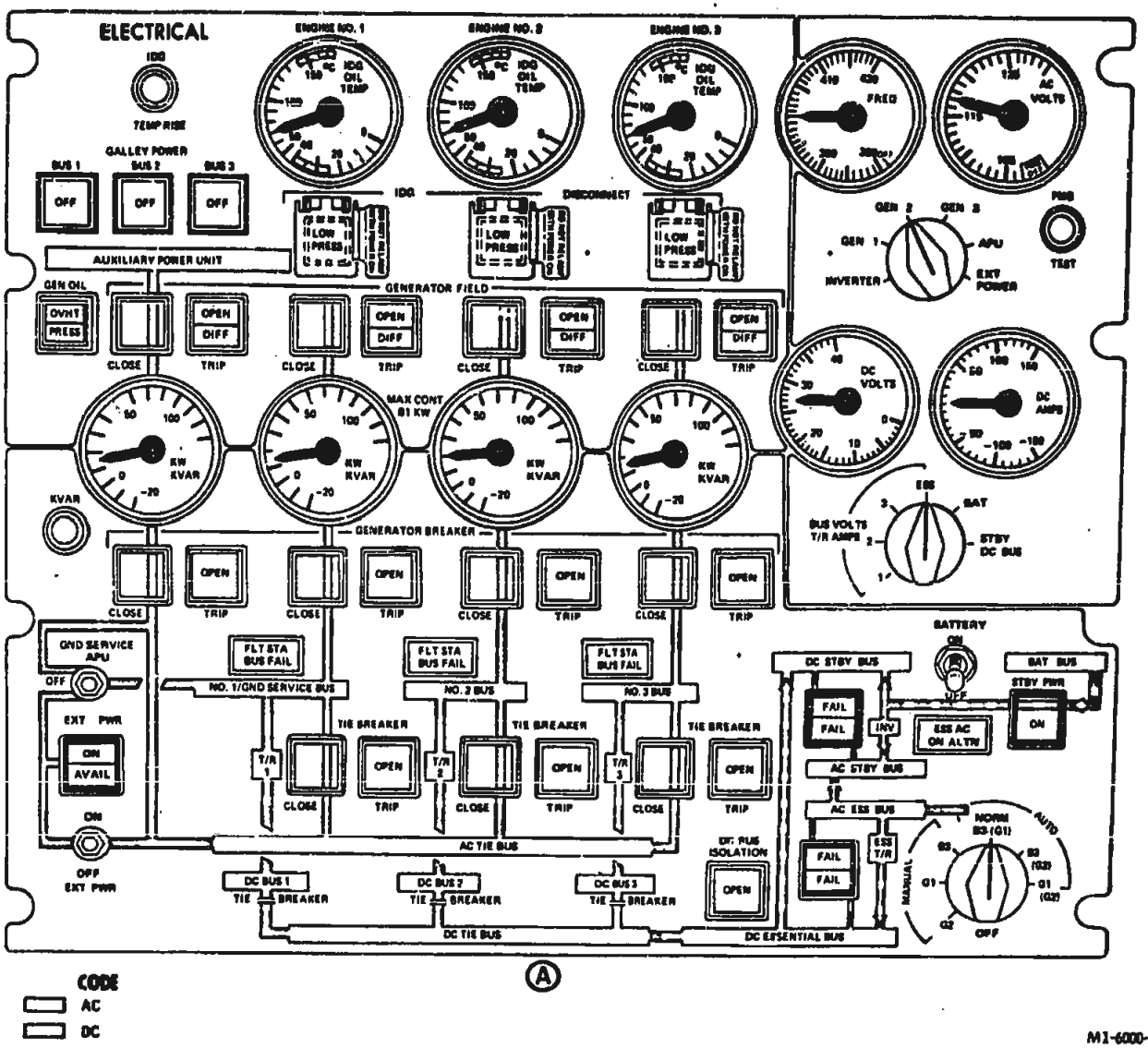
If the essential TR is the only dc power source, the dc tie breakers are energized from the dc essential bus through three diodes and through contacts of the closed DC BUS ISOLATION switchlight.

The dc essential bus FAIL indicator on the Flight Engineer/Second Officers electrical control panel and ESS/STBY PWR indicator on the pilots center instrument panel, zone 210, come on to indicate a failed dc essential bus.

A BUS VOLTS T/R AMPS rotary selector switch (Ref. Fig. 1) and a dc voltmeter and dc ammeter are located on the Flight Engineer/Second Officers electrical control panel. When the rotary switch is placed in position 1, 2, 3, or ESS, with the dc buses paralleled, a voltage which is common to all operating TR units will be indicated on the adjacent voltmeter. The ammeter will indicate the current being supplied to the system by the selected TR. With the dc buses isolated, the voltage output and current drain of the selected TR are indicated. With the rotary switch in the BAT position, the battery (Ref. 24-32-00) voltage and charge or discharge current are indicated. When the rotary switch is placed in the STBY BUS position, only the voltage on the dc standby bus (Ref. 24-32-00) is indicated. The ammeter will indicate zero (0) ampere.

R NOTE: With the four TR operating in parallel, the current
R output from any one TR must not deviate more or less than
R seven amperes from the average of the other three TR.





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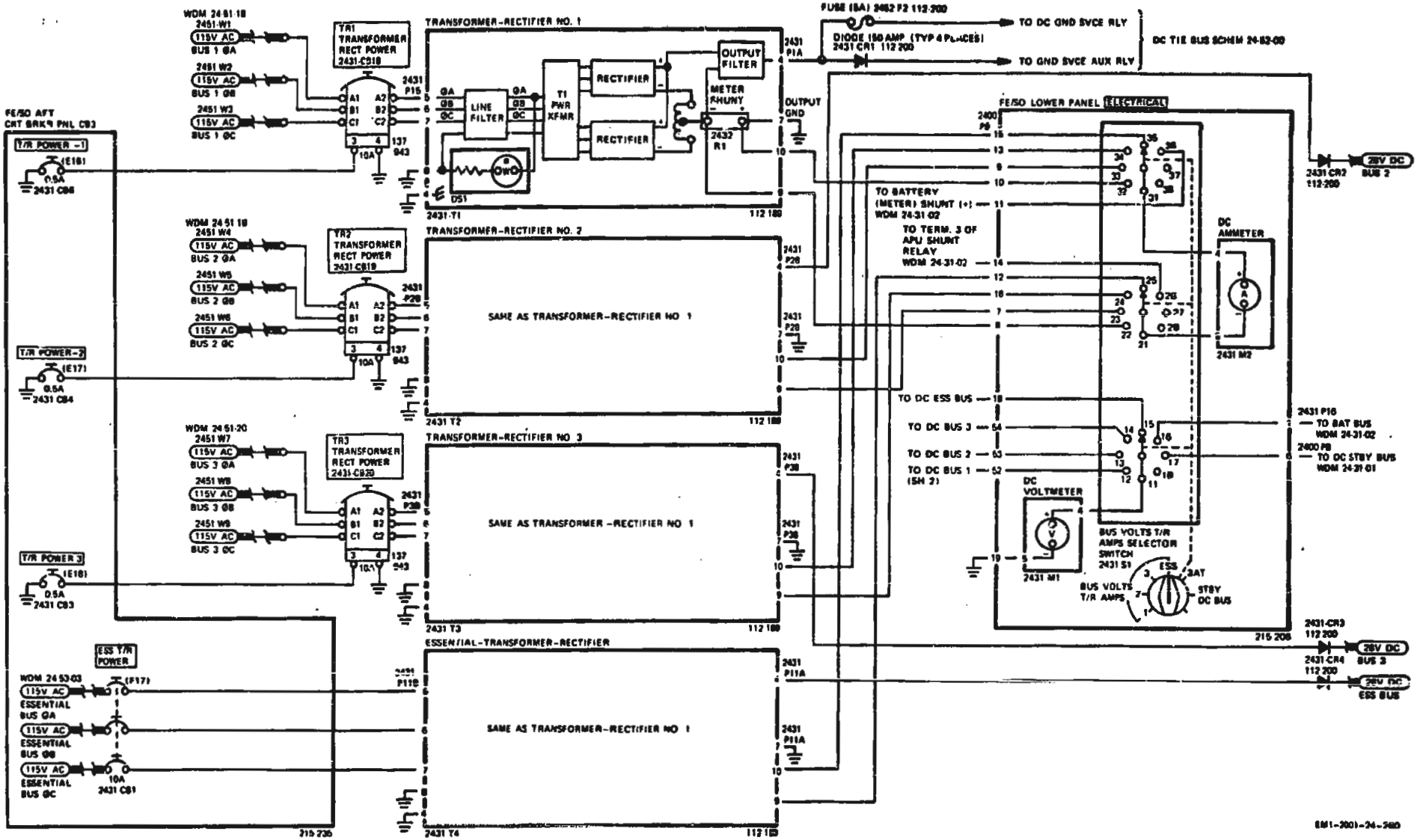
R Flight Engineer/Second Officers Electrical Control Panel
R Figure 1


TRANSFORMER-RECTIFIER NO. 1
TRANSFORMER-RECTIFIER NO. 2
SAME AS TRANSFORMER-RECTIFIER NO 1
TRANSFORMER-RECTIFIER NO 3
SAME AS TRANSFORMER -RECTIFIER NO 1
ESSENTIAL-TRANSFORMER-RECTIFIER
SAME AS TRANSFORMER-RECTIFIER NO 1
FE/SO LOWER PANEL ELECTRICAL
FE/SO AFT CRT BRKR PNL CB3
ESS T/R POWER
LINE FILTER
RECTIFIER
RECTIFIER
OUTPUT FILTER
METER SHUNT
DC AMMETER
DC VOLTMETER
BUS VOLTS T/R AMPS SELECTOR SWITCH 2431 S1
TO BATTERY (METER) SHUNT (+) WDM 24-31-02
TO TERM. 3 OF APU SHUNT RELAY WDM 24-31-02
TO DC ESS BUS
TO DC BUS 3
TO DC BUS 2
TO DC BUS 1 (SH 2)
TO DC GND SVCE RLY
TO GND SVCE AUX RLY
DC TIE BUS SCHEM 24-83-00
28V DC BUS 2
28V DC BUS 3
28V DC ESS BUS
2431 P16 — TO BAT BUS WDM 24-31-02
2400 P8 — TO DC STBY BUS WDM 24-31-01

DC Power System Functional Diagram
Figure 2

R EFFECTIVITY: ALL
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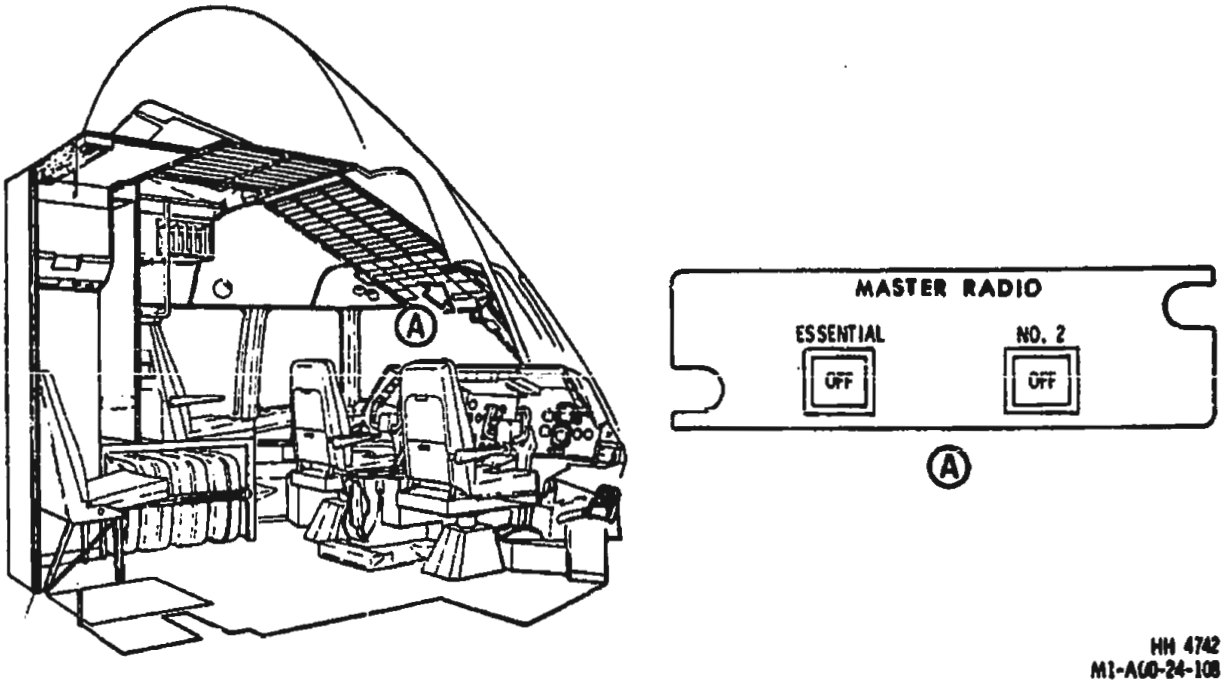
Two MASTER RADIO switchlights, ESSENTIAL and NO. 2, (Ref. Fig. 3) are located on the pilots overhead panel, zone 210. The switchlights light the OFF legend when placed in that position.

When the ESSENTIAL MASTER RADIO switchlight is depressed (latched in), the essential ac master (Ref. 24-51-00) and essential dc master radio relays are energized. The dc relay (Ref. Fig. 2) connects the dc essential bus to the dc essential radio bus on circuit breaker panel CB5. The relay also connects dc essential bus power (or battery bus power) to the VHF NO. 1
R circuit breaker on circuit breaker panel CB1, and to the main
R contacts of the battery communications relay.

A standby communications relay normally connects the VHF NO. 1 and essential communications circuits to the dc essential bus. If the dc essential bus fails, the relay deenergizes and transfers the circuits to the battery bus.

The battery communications relay is energized when the ESSENTIAL MASTER RADIO switchlight is off and the BATTERY switch (Ref. 24-32-00) is on. When energized, the battery communications relay allows the essential communications bus to be energized by bypassing the deenergized essential dc master radio relay. The standby communications, essential dc master radio, and battery communications relays are also used in the control circuit of the battery charger relay (Ref. 24-32-00).



Master Radio Switchlight Location
Figure 3

When the NO. 2 MASTER RADIO switchlight is depressed (latched in), the No. 2 ac master radio (Ref. 24-51-00) and No. 2 dc master radio relays are energized. When energized, the dc relay (Ref. Fig. 2) connects dc bus 2 power to the No. 2 dc radio bus on circuit breaker panel CB3.

3. 75-amp Transformer-Rectifier

A. Description

The transformer-rectifier (TR) (Ref. Fig. 4) is a compact low-voltage, high-current power supply which receives 115/200V ac, 400-Hz, three-phase, ac voltage from the primary ac power system and converts it to a nominal 28 to 30V dc. Maximum current output of the TR is 75 amperes with 55 pounds per hour forced air cooling, or 37.5 amperes with natural convection cooling only.

The power supply consists of an input power transformer which converts the high-voltage three-phase power to low-voltage six-phase power, 12 silicon power diodes to convert the six-phase power to direct current, an interphase transformer to balance the rectifier bridge circuit, and filtering components to prevent electromagnetic interference.

R R The TR is contained in a standard 3/8 ATR size case. The TR has cooling air outlet holes in the bottom of the case. The TR is rack mounted in the forward electrical service center, zone 112.

The TR contains no moving parts. A lamp on the front panel comes on to indicate that the unit is energized.

Table 1 lists the principal characteristics of the TR.

Transformer-Rectifier Characteristics
Table 1

ITEM	CHARACTERISTIC
Input voltage	115/200V, 400 Hz, three-phase
Output voltage	28 to 30V dc at load currents of 75 to 10 amp
Output current	75.0 amp continuous (with 55 lb per hr cooling air supplied)

Transformer-Rectifier Characteristics (Cont)
Table 1

ITEM	CHARACTERISTIC
Overload current	Shorted output for period not exceeding 1 second
	375 amp for 1 second
	175 amp for 1 minute
	100 amp for 5 minutes
Efficiency	85 percent minimum (at full load)
Power factor	90 percent minimum
Weight	12.95 pounds maximum

4. DC Voltmeter

A. Description

The dc voltmeter is located on the Flight Engineer/Second Officers electrical control panel, zone 215. The meter is used to monitor various dc voltage sources as selected by an associated BUS VOLTS T/R AMPS rotary selector switch.

The integrally lighted meter is contained in a case which has an end-mounted electrical connector.

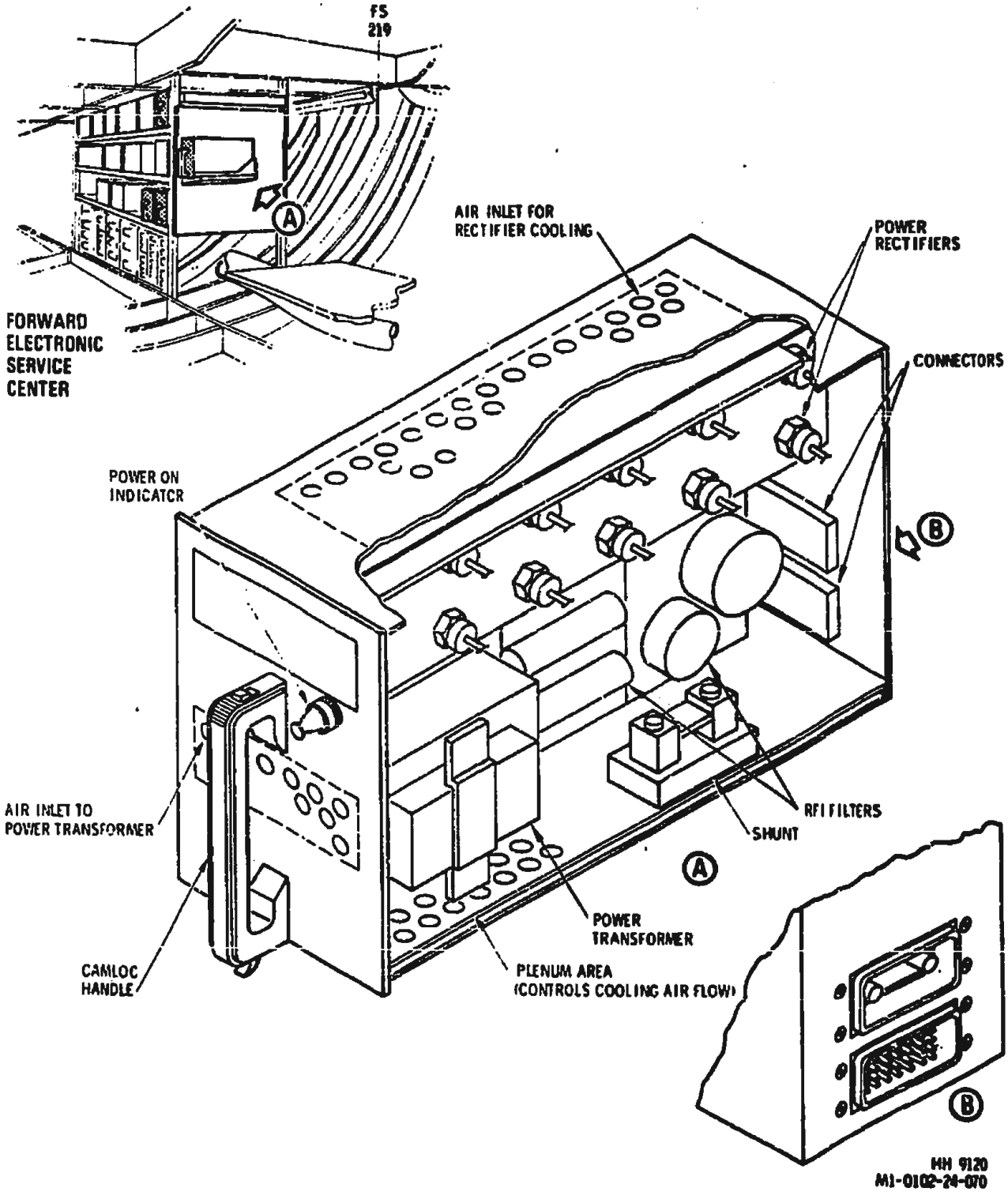
The meter face is graduated in 1-volt steps from 0 to 40 volts. At full scale deflection, the meter consumes 1.0 milliampere of dc current.

B. Operation

Voltage inputs to the meter are provided by the BUS VOLTS T/R AMPS selector switch which, when rotated, connects various aircraft dc voltage sources to the meter for monitoring. Integrally mounted lamps provide meter lighting from the 0 to 5V ac instrument lighting system.

5. DC Ammeter

A. Description



75 Amp Transformer-Rectifier
Figure 4

The dc ammeter is located on the Flight Engineer/Second Officers electrical control panel, zone 215. The meter indicates battery charge or discharge, or current drain from the various aircraft dc sources, as selected by an associated BUS VOLTS T/R AMPS rotary selector switch.

The integrally lighted meter is contained in a case which has an end-mounted electrical connector. The meter face is graduated in 10-amp steps. In the clockwise direction, the meter reads from 0 to plus 150 amperes. In the counterclockwise direction the meter reads from 0 to minus 150 amperes.

A 50-millivolt input causes the meter to indicate a full-scale reading of 150 amperes. The meter requires an external 50-millivolt, 150-ampere shunt.

B. Operation

Input to the ammeter is provided by two wafers of the BUS VOLTS T/R AMPS selector switch. When the switch is rotated, shunts associated with various dc sources are connected to the ammeter to provide the necessary current monitoring. When the switch is placed in the BAT position, the ammeter will read in a positive (+) direction if the battery is furnishing power. The ammeter will read in a negative (-) direction if the battery is being charged.

Integrally mounted lamps provide meter lighting from the 0 to 5V ac instrument lighting system.

6. Standby_Communications_Relay

A. Description

R On aircraft 001-031
R the standby communications relay is a 50-ampere,
R single-pole, double-throw unit, which has, in addition to
R the main 50-ampere contacts, two sets of SPDT auxiliary
R (aux) contacts. Threaded studs provide circuit connection
R points to the main contacts. A plug-in type connector is
R used to connect the aux contacts and the relay coil to the
R aircraft circuitry.

R On aircraft 032-999
R the standby communications relay is a 50-ampere,
R single-pole, single-throw unit, which has, in addition to
R the main 50-ampere contacts, two sets of SPST auxiliary
R (aux) contacts. Threaded studs provide connection points to
R the aircraft circuitry.

B. Operation

The normally energized relay senses essential bus voltage. If the essential bus fails, the standby communications relay will de-energize allowing battery power to supply the essential communication bus and VHF COMM No. 1.

When the relay is energized, one set of AUX contacts enables the battery charger relay circuit, and disables the circuit when the relay becomes deenergized. A second set of AUX contacts normally connects input power (terminal 15) of the essential master radio switchlight to the dc essential bus. The same contacts automatically transfer terminal 15 to the
R battery bus if the dc essential bus fails.

7. Battery Communications Relay

A. Description

R The battery communications relay is a 50-ampere,
R single-throw, single-pole unit, which has, in addition to
R the main 50-ampere contacts, two sets of SPST auxiliary
R contacts.

B. Operation

The 50-ampere contacts of the normally de-energized relay provide a path for the dc essential bus to provide power to the essential communication bus. With the battery switch in the ON position and the ESSENTIAL MASTER RADIO switchlight OFF, the battery communication relay will be energized. In this condition the essential master radio relay will be bypassed, and battery voltage will be supplied to the essential communications bus only.

8. No. 2 DC Master Radio Relay

A. Description

The No. 2 dc master radio relay, which is used in the dc distribution system, is a 50-ampere, single-pole, single-throw unit. The relay has, in addition to the main 50-ampere contacts, one set of single-pole, double-throw auxiliary contacts. When energized, the relay connects the No. 2 dc radio bus to dc bus 2.

The relay is energized when the NO. 2 MASTER RADIO switchlight on the pilots overhead circuit breaker panel CB1, zone 210, is depressed (latched in).

9. Essential DC Master Radio Relay

A. Description and Operation

The essential dc master radio relay, which is used in the dc distribution system, is a 25-ampere, triple-pole, single-throw, normally open unit. The relay has, in addition to the main 25-ampere contacts, one set of single-pole, double-throw auxiliary contacts.

When the relay is energized, one set of main contacts connect the dc essential radio bus to the dc essential bus. A second set of contacts provide a path for dc essential bus power (or battery bus power depending on the position of the standby communications relay) to the main contacts of the battery communications relay and to the VHF No. 1 circuit breaker on the pilots overhead circuit breaker panel CB1, zone 210. The auxiliary contacts are used in the battery charger relay control circuit (Ref. 24-32-00).

The relay is energized when the ESSENTIAL MASTER RADIO switchlight on the pilots overhead panel, zone 210, is depressed (latched in).

10. DC Ground Service Relay

A. Description and Operation

R The dc ground service relay is used to isolate and
R de-energize dc bus 1, and to energize the ground service bus
R tie breaker control relay when in the ground service
R operating mode (Ref. 24-41-00). The dc-operated, 50-ampere,
R single-pole, single-throw relay is located behind the lower
R section of the FE/SO aft circuit breaker panel CB3, zone
R 215.

DC POWER SYSTEM - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting DC Power System faults are included in this section of the manual. A DC Power System malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenannce personnel by a FIRM fault code number. This number and the flight log book write-up can be found in the Chapter 24 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a block number indicating the entry point containing the fault isolation procedure. When no block number is specified, the entry point is Block 1.

Prerequisites listed at the top of each diagram identify mandatory preliminary steps and circuit breakers that must be closed before initiating any fault isolation step.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring diagram manual pages required for checking component interconnect wiring.

R Figure 101, Compoment Location Index, is an alphabetical listing
R of all components associated with the DC power system. It gives
R the area and access of each component and its respective removal
R and installation reference.

R Figure 102, Component Locator Diagram, illustrates the location
R on the aircraft of all the components listed in the Component
R Location Index.

R Refer to the Maintenance Manual Introduction for a more detailed
R description of the Fault Isolation Reporting Method (FIRM) and
R of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 lists the fault isolation diagrams and schematics in this section.

Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Transformer Rectifier No. 1 Fault Isolation
104	Transformer Rectifier No. 2/3 Fault Isolation
105	Essential Transformer Rectifier Fault Isolation
106	DC Bus Paralleling System Fault Isolation
107	DC Meters System Fault Isolation
SCHEM 1	TR-1 System Schematic
SCHEM 2	TR-2/3 System Schematic
SCHEM 3	Essential TR Schematic
SCHEM 4	DC Bus Paralleling System Schematic
SCHEM 5	DC Meters Indicating System Schematic
SCHEM 6	DC Power System Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
BOX INDICATOR LIGHTS CONTROL	1	FESC, 112AB	33-17-04
CIRCUIT BREAKERS			
DC AUTO TRANSFER 2432-CB14	1	FLT STA/CB3 G13	•
DC ESS BUS-DC TIE BUS CONTROL 2450-CB7	1	FLT STA/CB3 F2	•
DC ESS BUS-DC TIE BUS POWER 2431-CB5	1	FLT STA/CB3 F3	•
DC PWR-TIE BUS CONT BUS1 2452-CB2	1	FLT STA/CB3 A9	•
DC PWR-TIE BUS CONT BUS2 2452-CB3	1	FLT STA/CB3 A10	•
DC PWR-TIE BUS CONT BUS3 2452-CB4	1	FLT STA/CB3 A11	•
DC PWR-TIE BUS PWR BUS1	1	FLT STA/CB3 A12	•
DC PWR-TIE BUS PWR BUS2 2431-CB8	1	FLT STA/CB3 A13	•
DC PWR-TIE BUS PWR BUS3 2432-CB7	1	FLT STA/CB3 A14	•
ESS MASTER RADIO CONT 2454-CB9	1	FLT STA/CB1 B10	•
ESS MASTER RADIO PWR 2454-CB8	1	FLT STA/CB1 B11	•
ESS TRANSFORMER RECTIFIER PWR 2431-CB1	1	FLT STA/CB3 F17	•
IND LT-FE PANEL LOWER 3317-CB9	1	FLT STA/CB2 J4	•
MECHANIC CALL 2345-CB1	1	FLT STA/CB2 L2	•
TR POWER TR1 2431-CB6	1	FLT STA/CB3 E16	•
TR POWER TR2 2431-CB4	1	FLT STA/CB3 E17	•
TR POWER TR3 2431-CB3	1	FLT STA/CB3 E18	•
TR POWER TR1 RCCB 2431-CB18	1	MESC RCCB BOX/192K	•
TR POWER TR2 RCCB 2431-CB19	1	MESC RCCB BOX/192K	•
TR POWER TR3 RCCB 2431-CB20	1	MESC RCCB BOX/192K	•
DIODES – POWER 2431-CR1, CR2, CR3, AND CR4	4	FESC, RH FWD RACK/112AB	24-31-12
DIODES – POWER 2452-CR1, CR2, CR3, CR4, CR5, AND CR6		FLT STA/BACK SIDE OF FE/SO ELECTRICAL CONTROL PANEL MOUNTED ON 2452-TB1	24-31-12
LIGHT – DC ESSENTIAL BUS FAIL		FLT STA/FE/SO ELECTRICAL CONTROL PANEL	20-33-04
METER – DC AMPS	1	FLT STA/FE/SO ELECTRICAL CONTROL PANEL	24-31-06
METER – DC VOLTS	1	FLT STA/FE/SO ELECTRICAL CONTROL PANEL	24-31-05
RECTIFIER – ESSENTIAL TRANSFORMER	1	FESC, RH ELECTRICAL RACK/112AB	24-31-01
RECTIFIER – NO. 1 TRANSFORMER	1	FESC, RH ELECTRICAL RACK/112AB	24-31-01
RECTIFIER – NO. 2 TRANSFORMER	1	FESC, RH ELECTRICAL RACK/112AB	24-31-01

*SEE WM EQUIPMENT LIST

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Component Location Index
Figure 101 (Sheet 1)

EFFECTIVITY: ALL

COMPONENT	QTY	AREA/ACCESS	REFERENCE
RECTIFIER – NO. 3 TRANSFORMER	1	FESC,RH ELECTRICAL RACK/112AB	24-31-01
RELAY – APU SHUNT 2432–KG	1	MESC BATTERY RELAY BOX/192K	20-24-01
RELAY – DC BUS NO. 1 TIE BREAKER	1	FLT STA BELOW THE FE/SO WORK TABLE	20-24-01
RELAY – DC BUS NO. 2 TIE BREAKER	1	FLT STA BELOW THE FE/SO WORK TABLE	20-24-01
RELAY – DC BUS NO. 3 TIE BREAKER	1	FLT STA BELOW THE FE/SO WORK TABLE	20-24-01
RELAY – DC ESSENTIAL BUS SENSING	1	FLT STA BELOW THE FE/SO WORK TABLE	20-24-01
RELAY – DC GROUND SERVICE	1	FLT STA BELOW THE FE/SO WORK TABLE	20-24-01
SWITCH – BUS VOLTS TR AMPS SELECTOR	1	FLT STA FE/SO ELECTRICAL CONTROL PANEL	20-24-01
SWITCHLIGHT – DC BUS ISOLATION	1	FLT STA FE/SO ELECTRICAL CONTROL PANEL	20-33-01

*SEE WM EQUIPMENT LIST

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Component Location Index
Figure 101 (Sheet 2)

EFFECTIVITY: ALL

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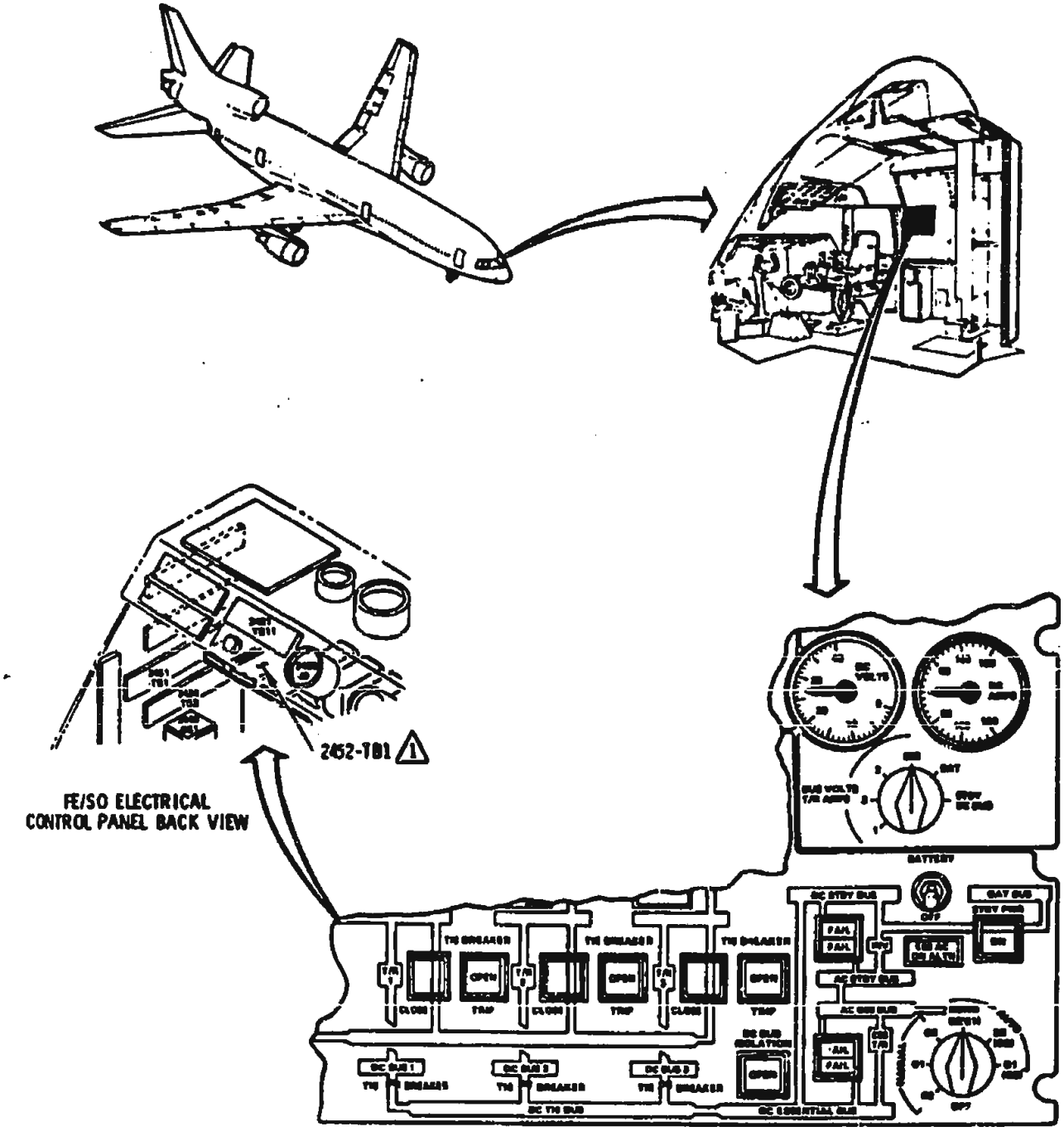

NOTE

⚠1 DIODES 2452-CR3, CR4, AND CR5 ARE MOUNTED ON TERMINAL BOARD 2452-TB1

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Component Locator Diagram
Figure 102 (Sheet 1)

EFFECTIVITY: ALL

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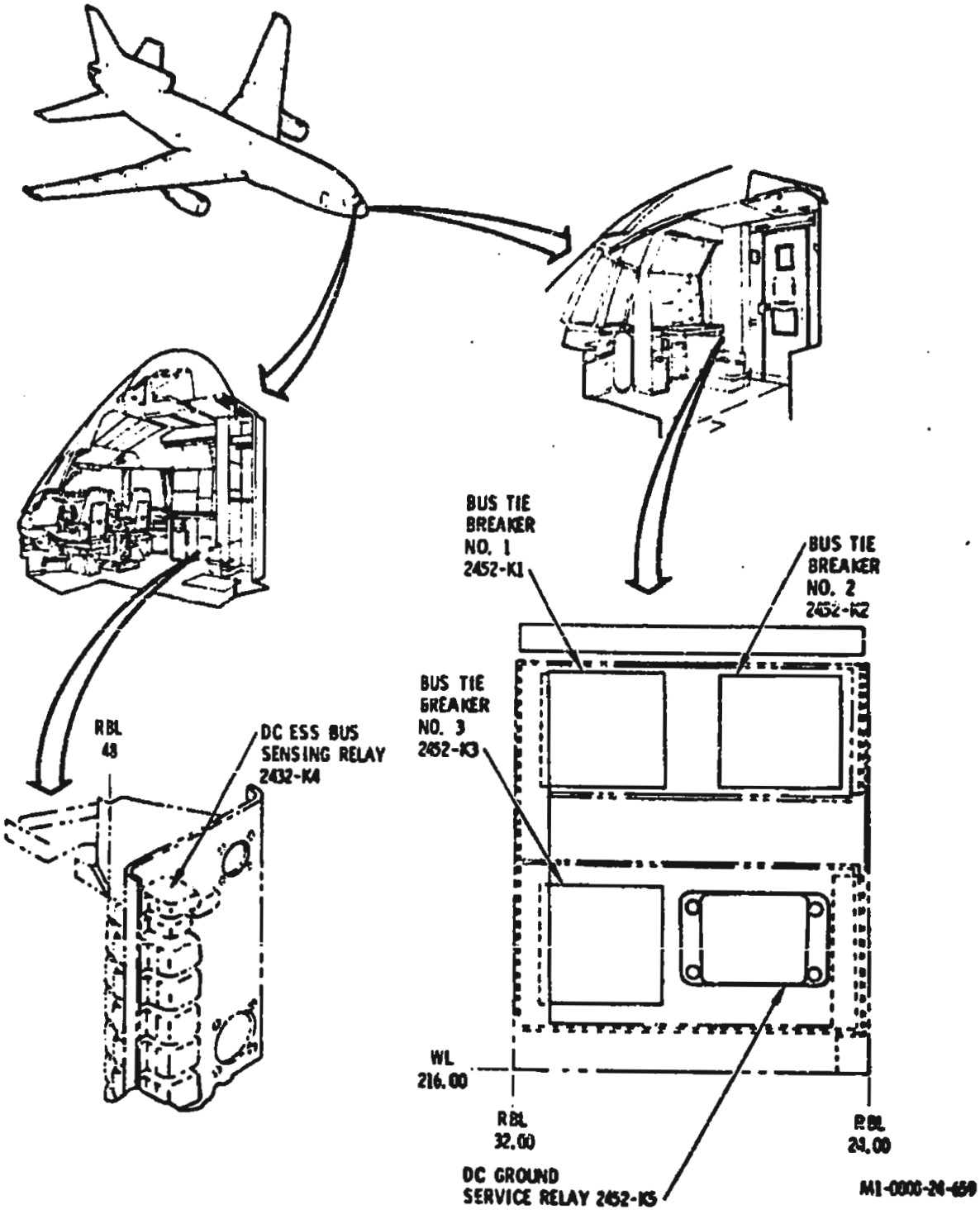

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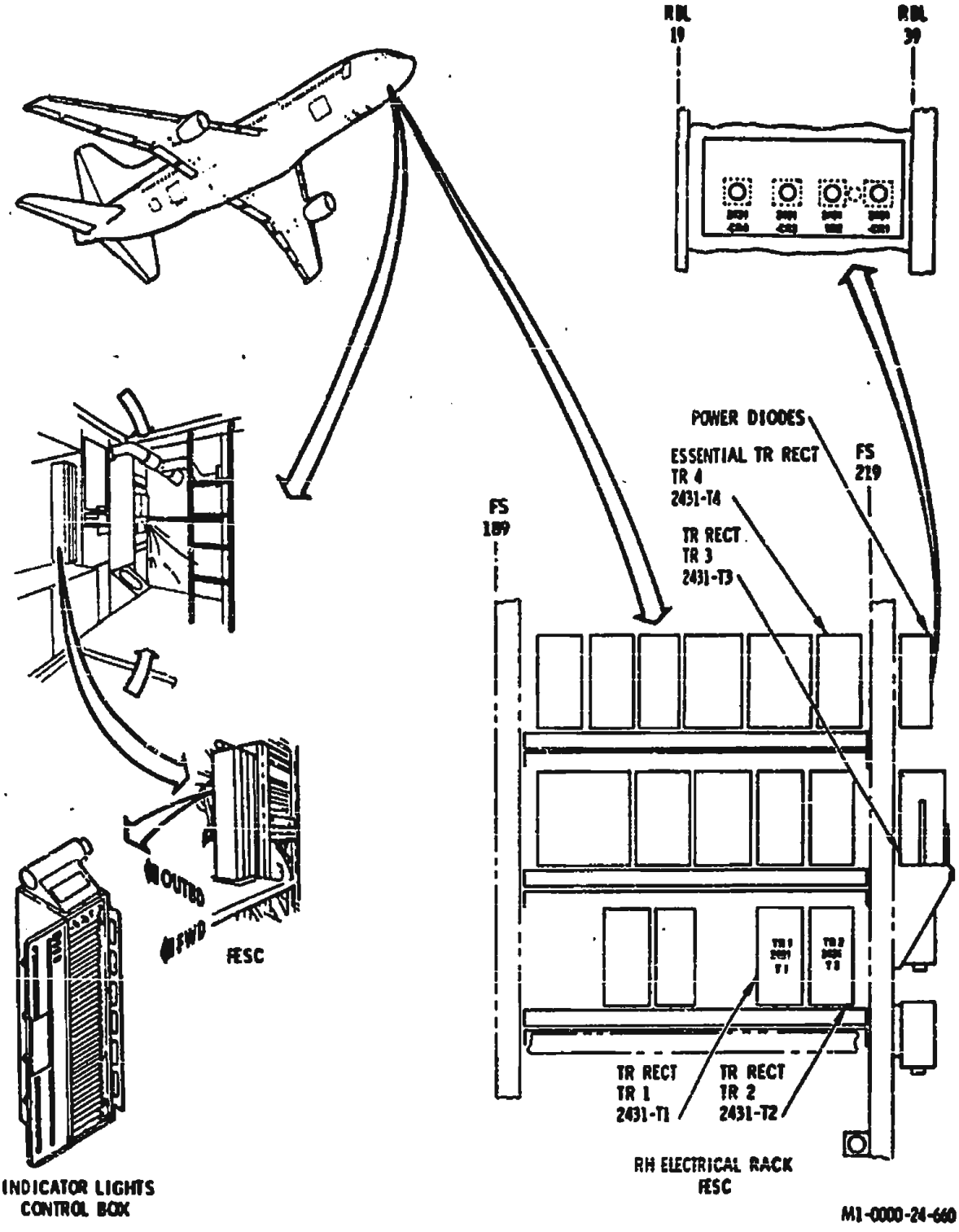
Component Locator Diagram
Figure 102 (Sheet 2)



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Component Locator Diagram
Figure 102 (Sheet 3)

EFFECTIVITY: ALL

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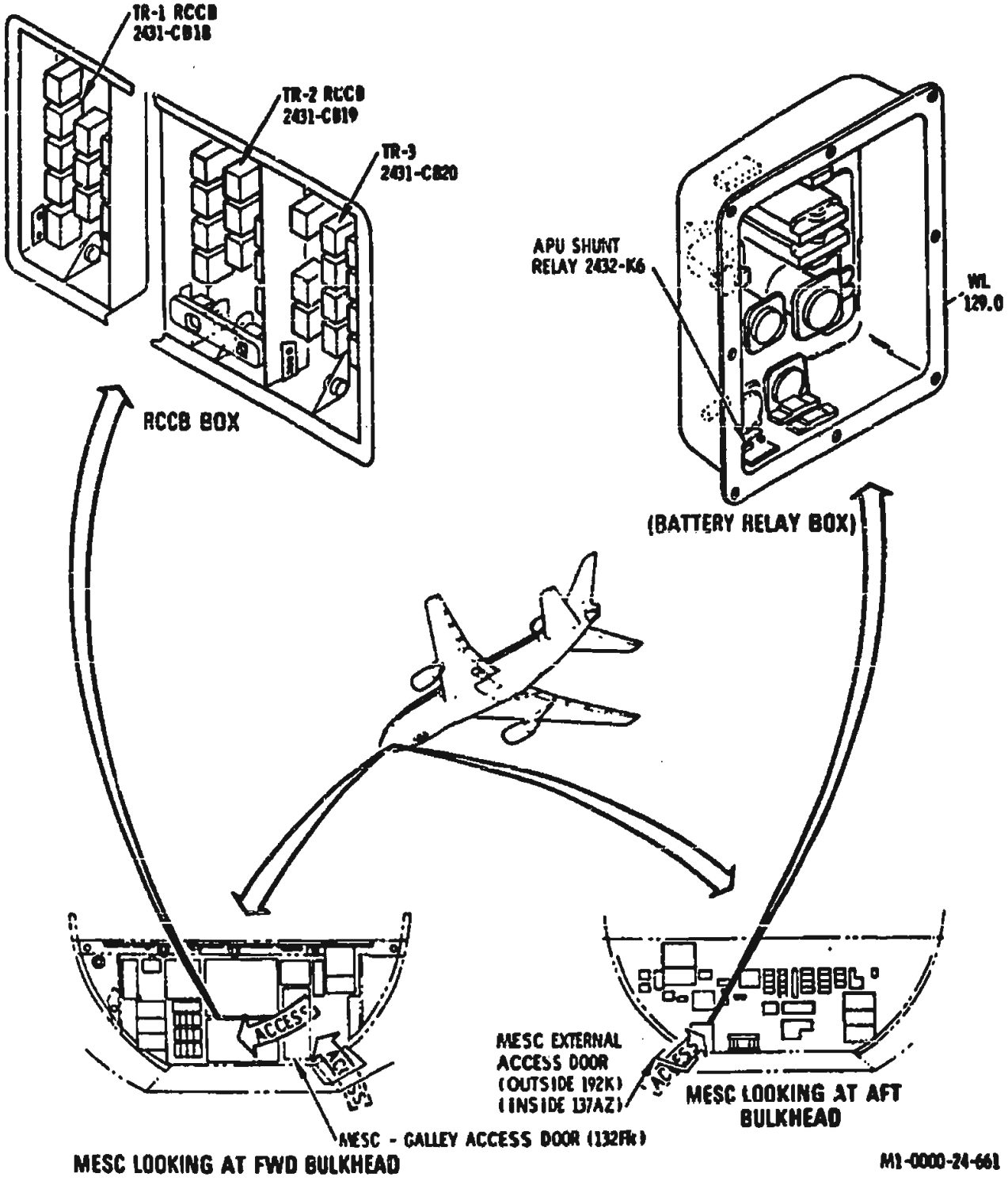

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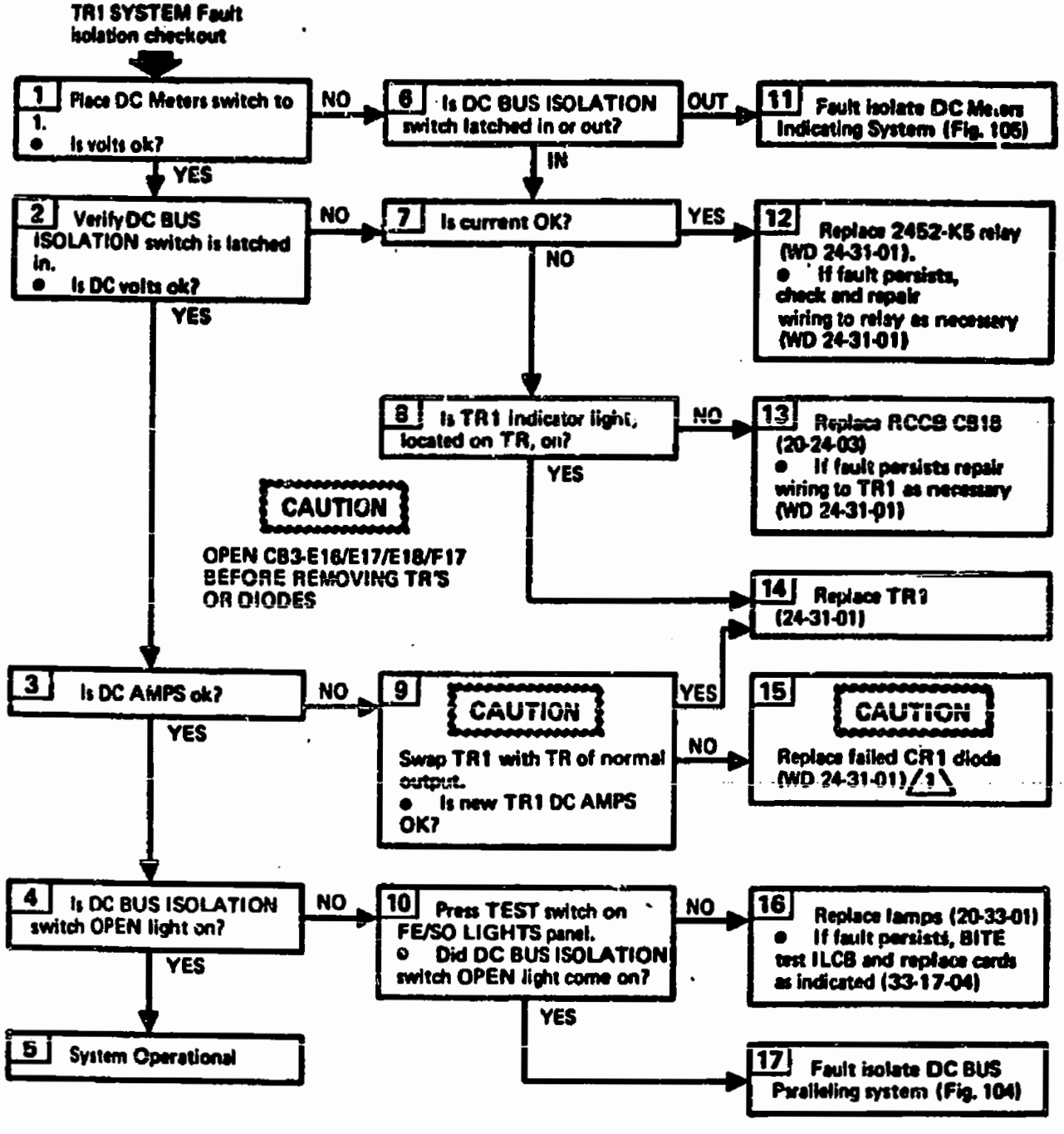
Component Locator Diagram
Figure 102 (Sheet 4)

EFFECTIVITY: ALL

001B


TR1 SYSTEM Fault Isolation checkout
1 Place DC Meters switch to 1.
• Is volts ok?
NO
6 Is DC BUS ISOLATION switch latched in or out?
OUT
11 Fault isolate DC Meters Indicating System (Fig. 105)
IN
YES
2 Verify DC BUS ISOLATION switch is latched in.
• Is DC volts ok?
NO
7 Is current OK?
YES
12 Replace 2452-K5 relay (WD 24-31-01).
• If fault persists, check and repair wiring to relay as necessary (WD 24-31-01)
NO
YES
8 Is TR1 indicator light, located on TR, on?
NO
13 Replace RCCB CB18 (20-24-03)
• If fault persists repair wiring to TR1 as necessary (WD 24-31-01)
YES
CAUTION
OPEN CB3-E16/E17/E18/F17 BEFORE REMOVING TR'S OR DIODES
14 Replace TR1 (24-31-01)
3 Is DC AMPS ok?
NO
9 CAUTION
Swap TR1 with TR of normal output.
• Is new TR1 DC AMPS OK?
YES
NO
15 CAUTION
Replace failed CR1 diode (WD 24-31-01) /1\
YES
4 Is DC BUS ISOLATION switch OPEN light on?
NO
10 Press TEST switch on FE/SO LIGHTS panel.
• Did DC BUS ISOLATION switch OPEN light come on?
NO
16 Replace lamps (20-33-01)
• If fault persists, BITE test ILCB and replace cards as indicated (33-17-04)
YES
5 System Operational
YES
17 Fault isolate DC BUS Paralleling system (Fig. 104)

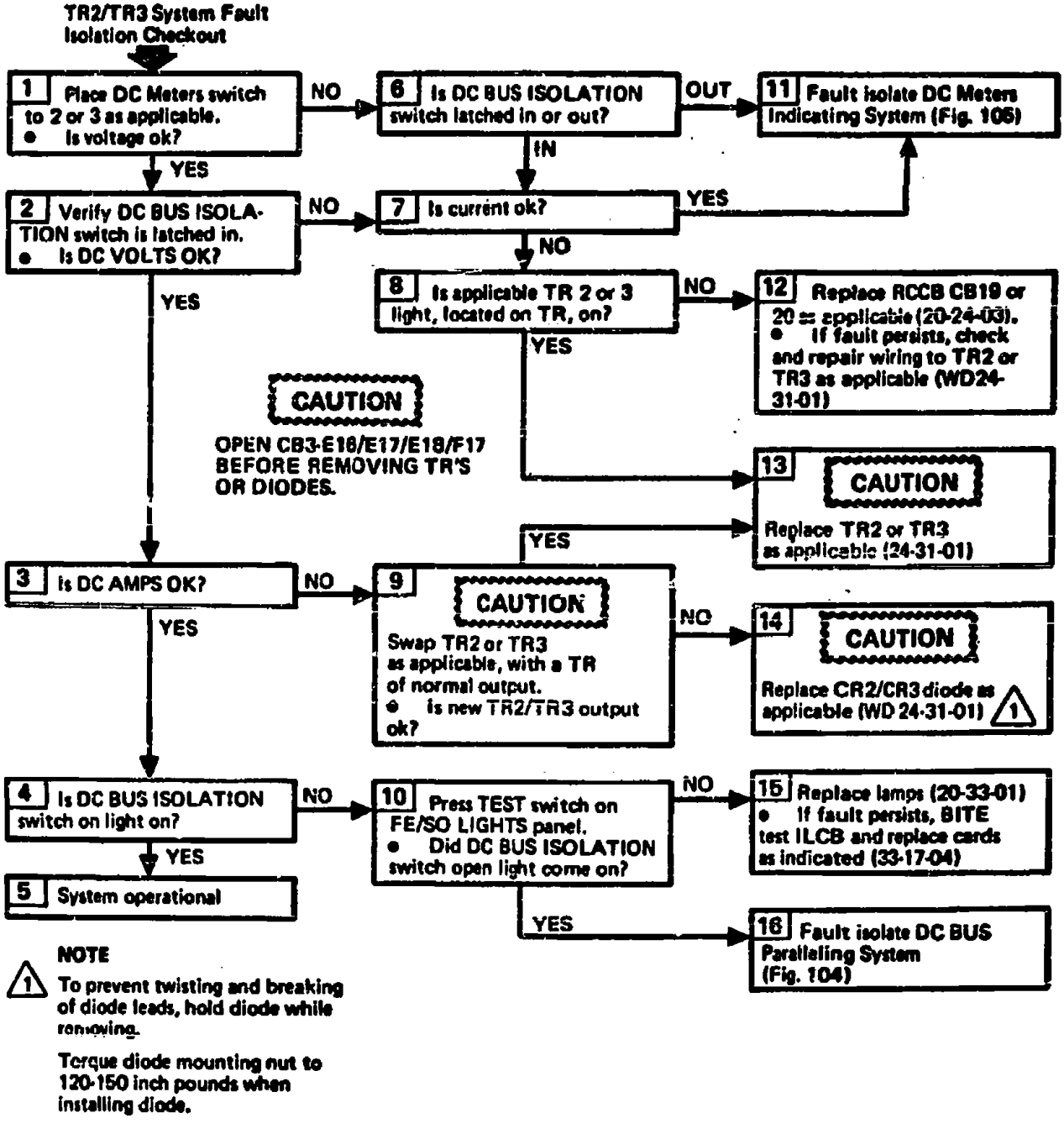
PREREQUISITES
Elect Pwr (24-41-00)
CB's: CB2-L2, J4
CB3-A9, A14, E16, E17, E18, F2, F3, F17
Galley left – 22G

NOTE

/1\ To prevent twisting and breaking of diode leads, hold diode while removing. Torque diode mounting nut to 120-150 inch pounds when installing diode

EM1-0102-24-661

R R Transformer-Rectifier No. 1 Fault Isolation
Figure 103


TR2/TR3 System Fault Isolation Checkout
1 Place DC Meters switch to 2 or 3 as applicable.
• Is voltage ok?
NO
6 Is DC BUS ISOLATION switch latched in or out?
OUT
11 Fault isolate DC Meters Indicating System (Fig. 105)
YES
IN
2 Verify DC BUS ISOLATION switch is latched in.
• Is DC VOLTS OK?
NO
7 Is current ok?
YES
NO
YES
8 Is applicable TR 2 or 3 light, located on TR, on?
NO
12 Replace RCCB CB19 or 20 as applicable (20-24-03).
• If fault persists, check and repair wiring to TR2 or TR3 as applicable (WD24-31-01)
YES
CAUTION
OPEN CB3-E16/E17/E18/F17 BEFORE REMOVING TR'S OR DIODES.
13 CAUTION
Replace TR2 or TR3 as applicable (24-31-01)
YES
3 Is DC AMPS OK?
NO
9 CAUTION
Swap TR2 or TR3 as applicable, with a TR of normal output.
• Is new TR2/TR3 output ok?
NO
14 CAUTION
Replace CR2/CR3 diode as applicable (WD 24-31-01) 1
YES
4 Is DC BUS ISOLATION switch on light on?
NO
10 Press TEST switch on FE/SO LIGHTS panel.
• Did DC BUS ISOLATION switch open light come on?
NO
15 Replace lamps (20-33-01)
• If fault persists, BITE test ILCB and replace cards as indicated (33-17-04)
YES
5 System operational
YES
16 Fault isolate DC BUS Paralleling System (Fig. 104)

NOTE

1 To prevent twisting and breaking of diode leads, hold diode while removing.

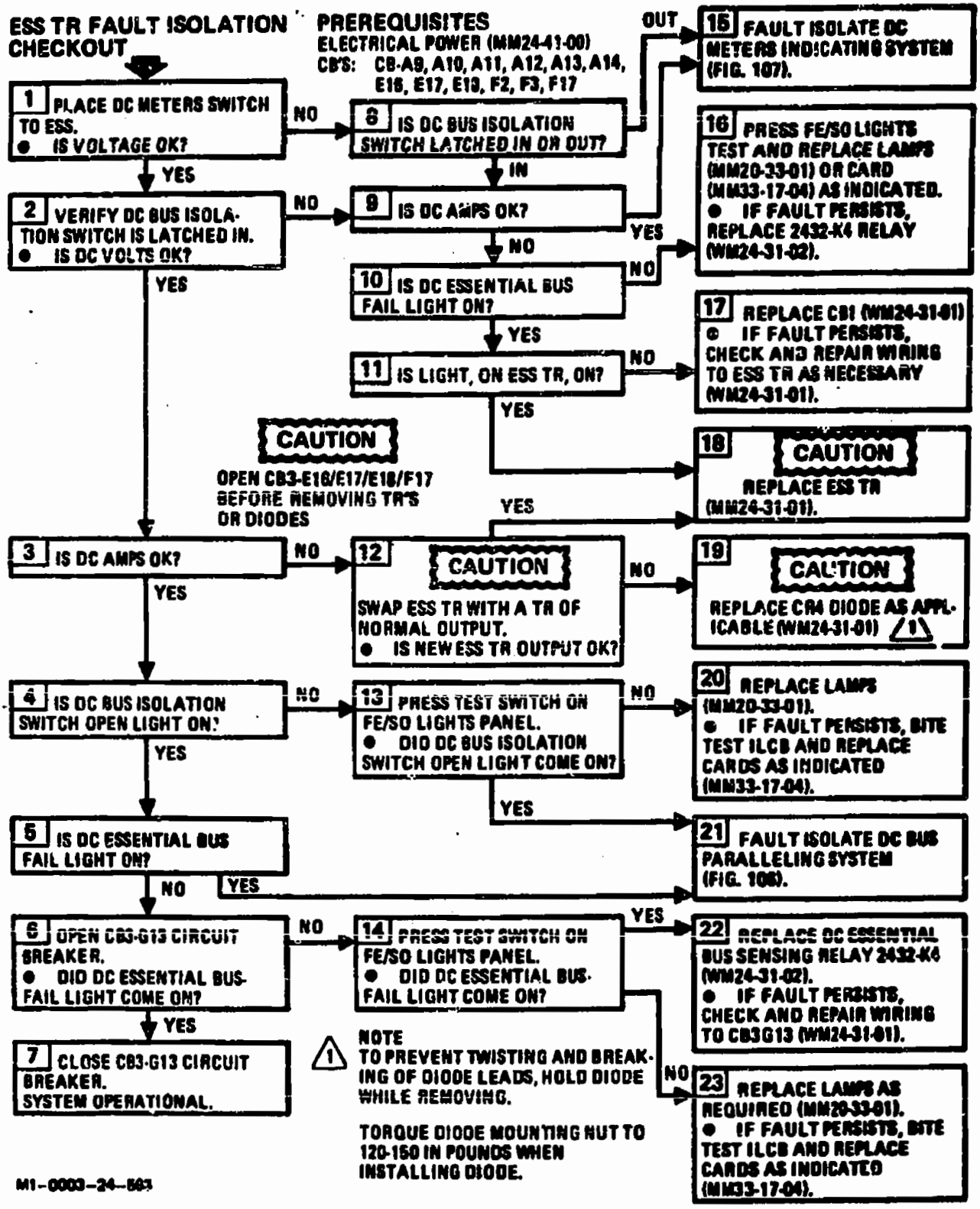
Torque diode mounting nut to 120-150 inch pounds when installing diode.

PREREQUISITES

Elect Pwr (24-41-00)
CB's: CB3-A9, A10, A11, A12, A13, A14, E16, E17, E18, F2, F3

EM1-0101-24-562

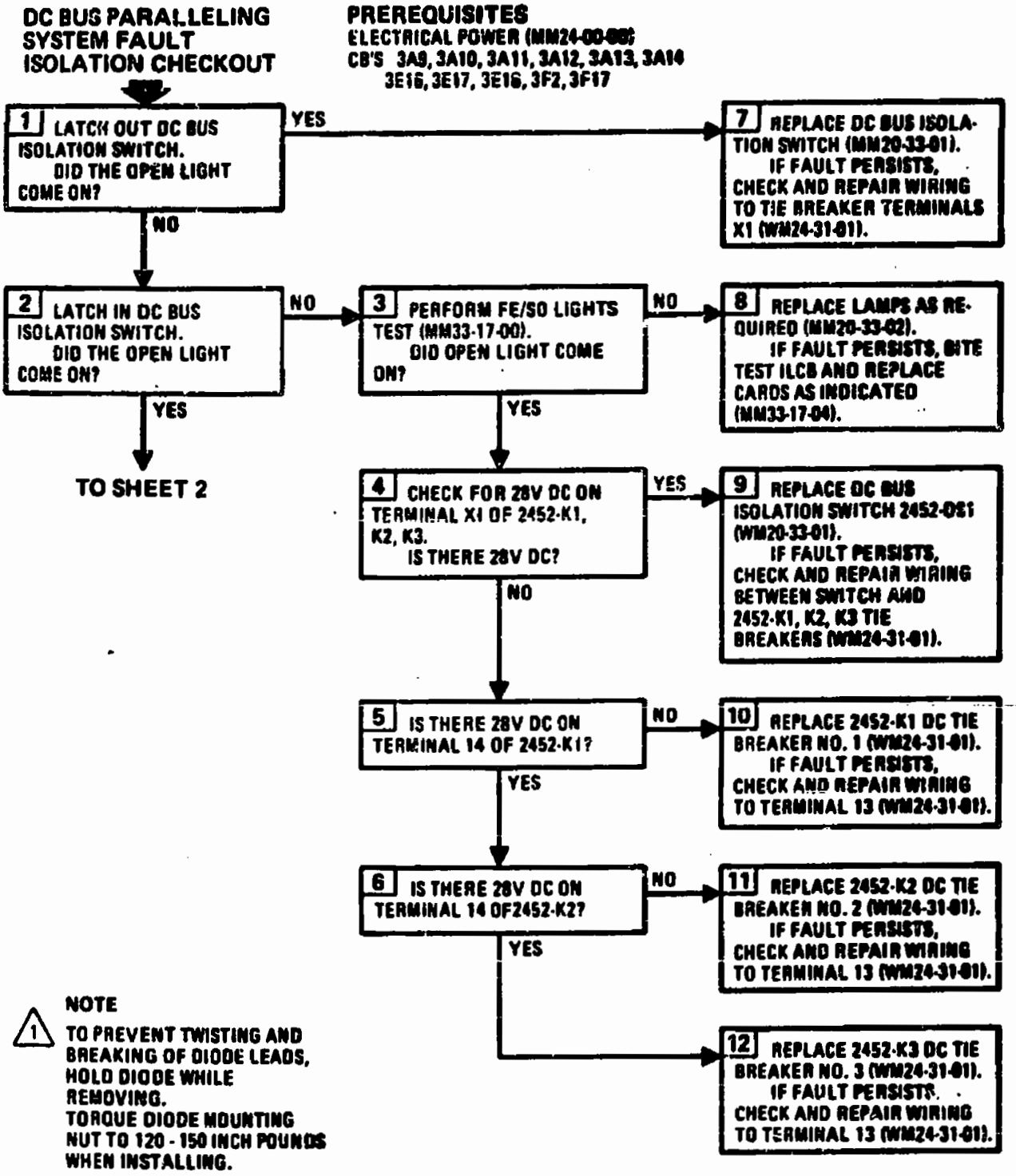
R R Transformer-Rectifier No. 2/3 Fault Isolation
Figure 104


ESS TR FAULT ISOLATION CHECKOUT
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: CB-A9, A10, A11, A12, A13, A14, E16, E17, E18, F2, F3, F17
1 PLACE DC METERS SWITCH TO ESS.
● IS VOLTAGE OK?
NO
8 IS DC BUS ISOLATION SWITCH LATCHED IN OR OUT?
OUT
15 FAULT ISOLATE DC METERS INDICATING SYSTEM (FIG. 107).
YES
IN
2 VERIFY DC BUS ISOLATION SWITCH IS LATCHED IN.
● IS DC VOLTS OK?
NO
9 IS DC AMPS OK?
YES
16 PRESS FE/SO LIGHTS TEST AND REPLACE LAMPS (MM20-33-01) OR CARD (MM33-17-04) AS INDICATED.
● IF FAULT PERSISTS, REPLACE 2432-K4 RELAY (WM24-31-02).
NO
YES
NO
10 IS DC ESSENTIAL BUS FAIL LIGHT ON?
YES
17 REPLACE CB1 (WM24-31-01)
● IF FAULT PERSISTS, CHECK AND REPAIR WIRING TO ESS TR AS NECESSARY (WM24-31-01).
11 IS LIGHT, ON ESS TR, ON?
NO
YES
CAUTION
OPEN CB3-E16/E17/E18/F17 BEFORE REMOVING TR'S OR DIODES
18 CAUTION
REPLACE ESS TR (MM24-31-01).
YES
3 IS DC AMPS OK?
NO
12 CAUTION
SWAP ESS TR WITH A TR OF NORMAL OUTPUT.
● IS NEW ESS TR OUTPUT OK?
NO
19 CAUTION
REPLACE CR4 DIODE AS APPLICABLE (WM24-31-01) /1\
YES
4 IS DC BUS ISOLATION SWITCH OPEN LIGHT ON?
NO
13 PRESS TEST SWITCH ON FE/SO LIGHTS PANEL.
● DID DC BUS ISOLATION SWITCH OPEN LIGHT COME ON?
NO
20 REPLACE LAMPS (MM20-33-01).
● IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
YES
YES
5 IS DC ESSENTIAL BUS FAIL LIGHT ON?
21 FAULT ISOLATE DC BUS PARALLELING SYSTEM (FIG. 106).
NO
YES
6 OPEN CB3-G13 CIRCUIT BREAKER.
● DID DC ESSENTIAL BUS FAIL LIGHT COME ON?
NO
14 PRESS TEST SWITCH ON FE/SO LIGHTS PANEL.
● DID DC ESSENTIAL BUS FAIL LIGHT COME ON?
YES
22 REPLACE DC ESSENTIAL BUS SENSING RELAY 2432-K4 (WM24-31-02).
● IF FAULT PERSISTS, CHECK AND REPAIR WIRING TO CB3G13 (WM24-31-01).
YES
7 CLOSE CB3-G13 CIRCUIT BREAKER.
SYSTEM OPERATIONAL.
/1\ NOTE
TO PREVENT TWISTING AND BREAKING OF DIODE LEADS, HOLD DIODE WHILE REMOVING.
TORQUE DIODE MOUNTING NUT TO 120-150 IN POUNDS WHEN INSTALLING DIODE.
NO
23 REPLACE LAMPS AS REQUIRED (MM20-33-01).
● IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
M1-0003-24-563

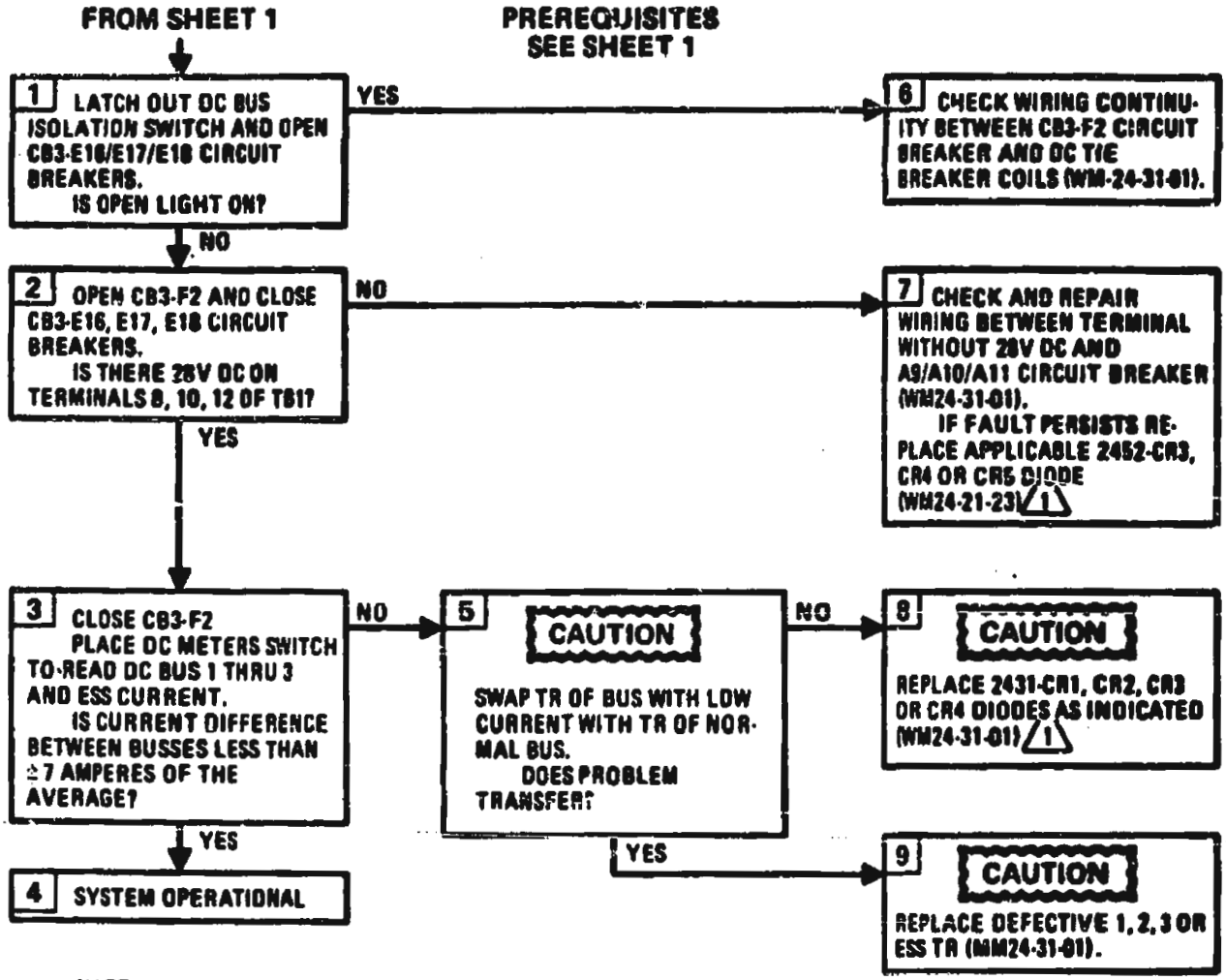
R R Essential Transformer-Rectifier Fault Isolation
Figure 105

R R EFFECTIVITY: ALL

001B


DC BUS PARALLELING SYSTEM FAULT ISOLATION CHECKOUT
PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
CB'S 3A9, 3A10, 3A11, 3A12, 3A13, 3A14 3E16, 3E17, 3E16, 3F2, 3F17
1 LATCH OUT DC BUS ISOLATION SWITCH. DID THE OPEN LIGHT COME ON?
YES
7 REPLACE DC BUS ISOLATION SWITCH (MM20-33-01). IF FAULT PERSISTS, CHECK AND REPAIR WIRING TO TIE BREAKER TERMINALS X1 (WM24-31-01).
NO
2 LATCH IN DC BUS ISOLATION SWITCH. DID THE OPEN LIGHT COME ON?
NO
3 PERFORM FE/SO LIGHTS TEST (MM33-17-00). DID OPEN LIGHT COME ON?
NO
8 REPLACE LAMPS AS REQUIRED (MM20-33-02). IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
YES
TO SHEET 2
YES
4 CHECK FOR 28V DC ON TERMINAL X1 OF 2452-K1, K2, K3. IS THERE 28V DC?
YES
9 REPLACE DC BUS ISOLATION SWITCH 2452-DS1 (WM20-33-01). IF FAULT PERSISTS, CHECK AND REPAIR WIRING BETWEEN SWITCH AND 2452-K1, K2, K3 TIE BREAKERS (WM24-31-01).
NO
5 IS THERE 28V DC ON TERMINAL 14 OF 2452-K1?
NO
10 REPLACE 2452-K1 DC TIE BREAKER NO. 1 (WM24-31-01). IF FAULT PERSISTS, CHECK AND REPAIR WIRING TO TERMINAL 13 (WM24-31-01).
YES
6 IS THERE 28V DC ON TERMINAL 14 OF2452-K2?
NO
11 REPLACE 2452-K2 DC TIE BREAKER NO. 2 (WM24-31-01). IF FAULT PERSISTS, CHECK AND REPAIR WIRING TO TERMINAL 13 (WM24-31-01).
YES
12 REPLACE 2452-K3 DC TIE BREAKER NO. 3 (WM24-31-01). IF FAULT PERSISTS. CHECK AND REPAIR WIRING TO TERMINAL 13 (WM24-31-01).
1 NOTE
TO PREVENT TWISTING AND BREAKING OF DIODE LEADS, HOLD DIODE WHILE REMOVING.
TORQUE DIODE MOUNTING NUT TO 120 - 150 INCH POUNDS WHEN INSTALLING.
M1-0002-24-584

R DC Bus Paralleling System Fault Isolation
R Figure 106 (Sheet 1)


FROM SHEET 1
PREREQUISITES SEE SHEET 1
1 LATCH OUT DC BUS ISOLATION SWITCH AND OPEN CB3-E16/E17/E18 CIRCUIT BREAKERS. IS OPEN LIGHT ON?
YES
6 CHECK WIRING CONTINUITY BETWEEN CB3-F2 CIRCUIT BREAKER AND DC TIE BREAKER COILS (WM-24-31-01).
NO
2 OPEN CB3-F2 AND CLOSE CB3-E16, E17, E18 CIRCUIT BREAKERS. IS THERE 28V DC ON TERMINALS 8, 10, 12 OF TB1?
NO
7 CHECK AND REPAIR WIRING BETWEEN TERMINAL WITHOUT 28V DC AND A9/A10/A11 CIRCUIT BREAKER (WM24-31-01). IF FAULT PERSISTS REPLACE APPLICABLE 2452-CR3, CR4 OR CR5 DIODE (WM24-21-23) 1
YES
3 CLOSE CB3-F2 PLACE DC METERS SWITCH TO READ DC BUS 1 THRU 3 AND ESS CURRENT. IS CURRENT DIFFERENCE BETWEEN BUSSES LESS THAN ±7 AMPERES OF THE AVERAGE?
NO
5 CAUTION
SWAP TR OF BUS WITH LOW CURRENT WITH TR OF NORMAL BUS. DOES PROBLEM TRANSFER?
NO
8 CAUTION
REPLACE 2431-CR1, CR2, CR3 OR CR4 DIODES AS INDICATED (WM24-31-01) 1
YES
YES
4 SYSTEM OPERATIONAL
9 CAUTION
REPLACE DEFECTIVE 1, 2, 3 OR ESS TR (MM24-31-01).

1 NOTE

TO PREVENT TWISTING AND BREAKING OF DIODE LEADS, HOLD DIODE WHILE REMOVING.

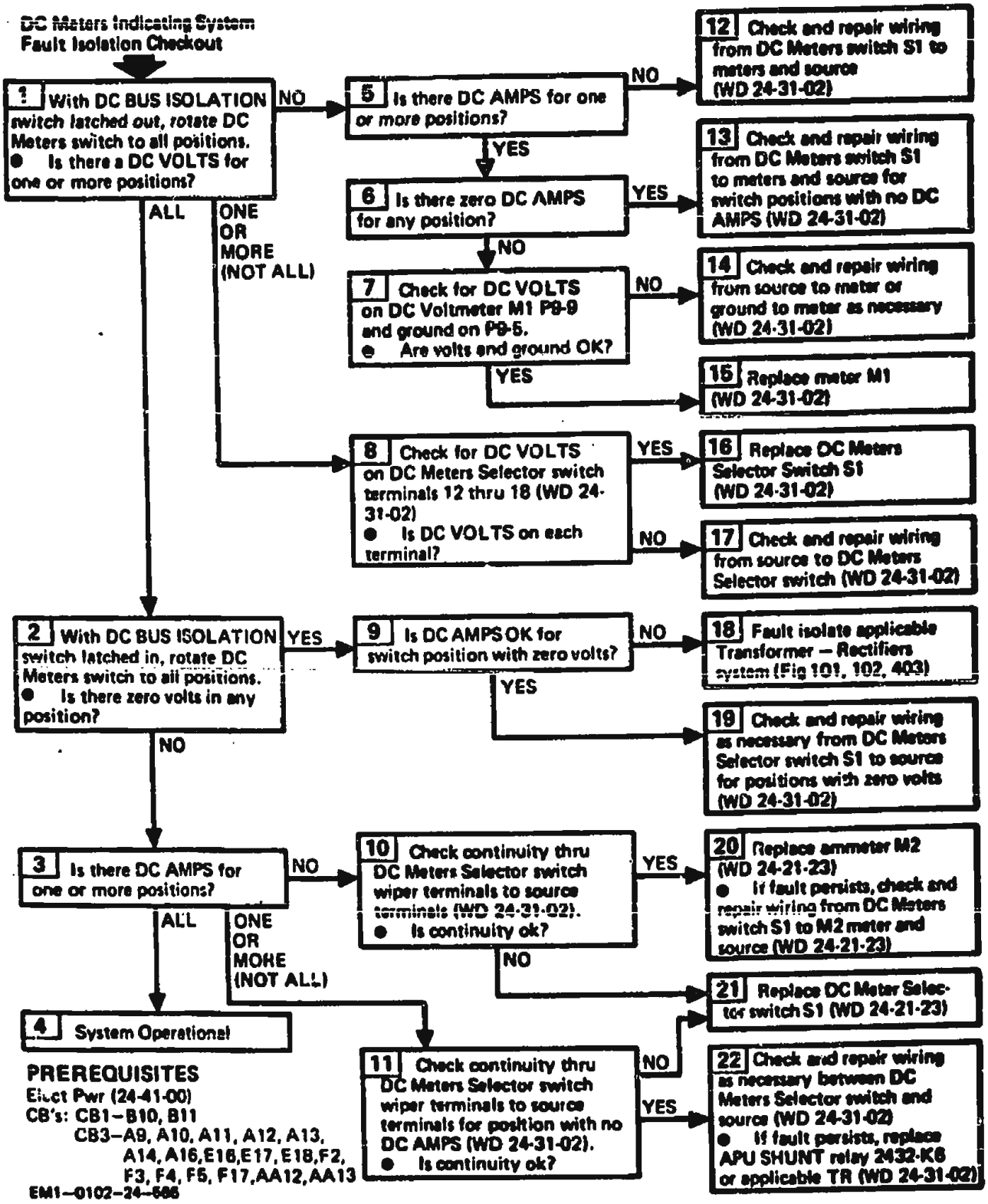
TORQUE DIODE MOUNTING NUT TO 120 - 150 INCH POUNDS WHEN INSTALLING.

CAUTION

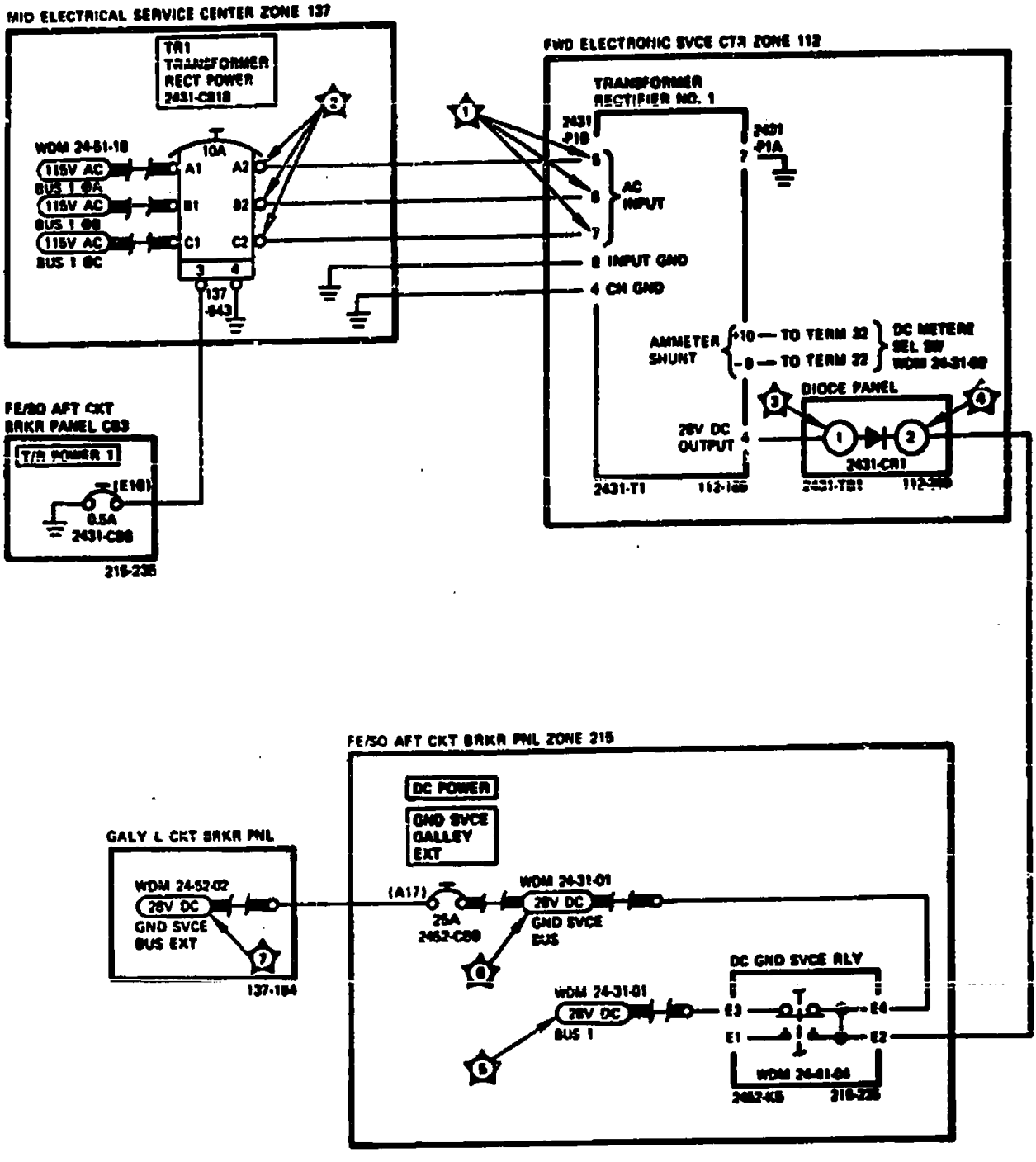
OPEN CB3-E16, E17, E18 AND F17 BEFORE REMOVING TR'S OR DIODES

M1-0000-24-728

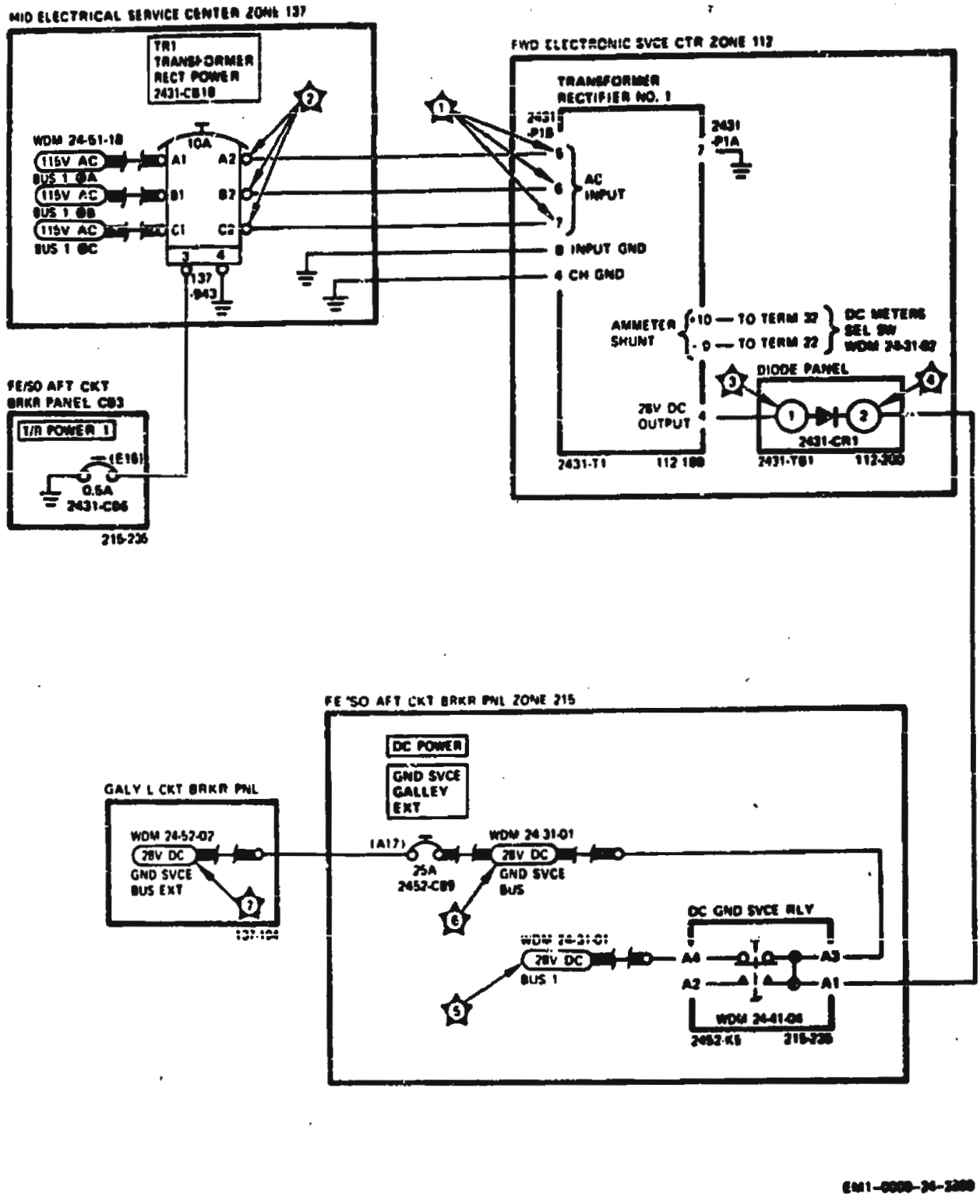
R R DC Bus Paralleling System Fault Isolation
Figure 106 (Sheet 2)


DC Meters Indicating System
Fault Isolation Checkout
1 With DC BUS ISOLATION switch latched out, rotate DC Meters switch to all positions.
● Is there a DC VOLTS for one or more positions?
NO
ALL
ONE OR MORE (NOT ALL)
5 Is there DC AMPS for one or more positions?
NO
YES
12 Check and repair wiring from DC Meters switch S1 to meters and source (WD 24-31-02)
6 Is there zero DC AMPS for any position?
YES
NO
13 Check and repair wiring from DC Meters switch S1 to meters and source for switch positions with no DC AMPS (WD 24-31-02)
7 Check for DC VOLTS on DC Voltmeter M1 P9-9 and ground on P9-5.
● Are volts and ground OK?
NO
YES
14 Check and repair wiring from source to meter or ground to meter as necessary (WD 24-31-02)
15 Replace meter M1 (WD 24-31-02)
8 Check for DC VOLTS on DC Meters Selector switch terminals 12 thru 18 (WD 24-31-02)
● Is DC VOLTS on each terminal?
YES
NO
16 Replace DC Meters Selector Switch S1 (WD 24-31-02)
17 Check and repair wiring from source to DC Meters Selector switch (WD 24-31-02)
2 With DC BUS ISOLATION switch latched in, rotate DC Meters switch to all positions.
● Is there zero volts in any position?
YES
NO
9 Is DC AMPS OK for switch position with zero volts?
NO
YES
18 Fault isolate applicable Transformer – Rectifiers system (Fig 101, 102, 403)
19 Check and repair wiring as necessary from DC Meters Selector switch S1 to source for positions with zero volts (WD 24-31-02)
3 Is there DC AMPS for one or more positions?
NO
ALL
ONE OR MORE (NOT ALL)
10 Check continuity thru DC Meters Selector switch wiper terminals to source terminals (WD 24-31-02).
● Is continuity ok?
YES
NO
20 Replace ammeter M2 (WD 24-21-23)
● If fault persists, check and repair wiring from DC Meters switch S1 to M2 meter and source (WD 24-21-23)
21 Replace DC Meter Selector switch S1 (WD 24-21-23)
4 System Operational
PREREQUISITES
Elect Pwr (24-41-00)
CB's: CB1–B10, B11
CB3–A9, A10, A11, A12, A13, A14, A16, E16, E17, E18, F2, F3, F4, F5, F17, AA12, AA13
EM1–0102–24–586
11 Check continuity thru DC Meters Selector switch wiper terminals to source terminals for position with no DC AMPS (WD 24-31-02).
● Is continuity ok?
NO
YES
22 Check and repair wiring as necessary between DC Meters Selector switch and source (WD 24-31-02)
● If fault persists, replace APU SHUNT relay 2432-K6 or applicable TR (WD 24-31-02)

DC Meters Indicating System Fault Isolation
Figure 107



TR-1 System Schematic
SCHEM 1

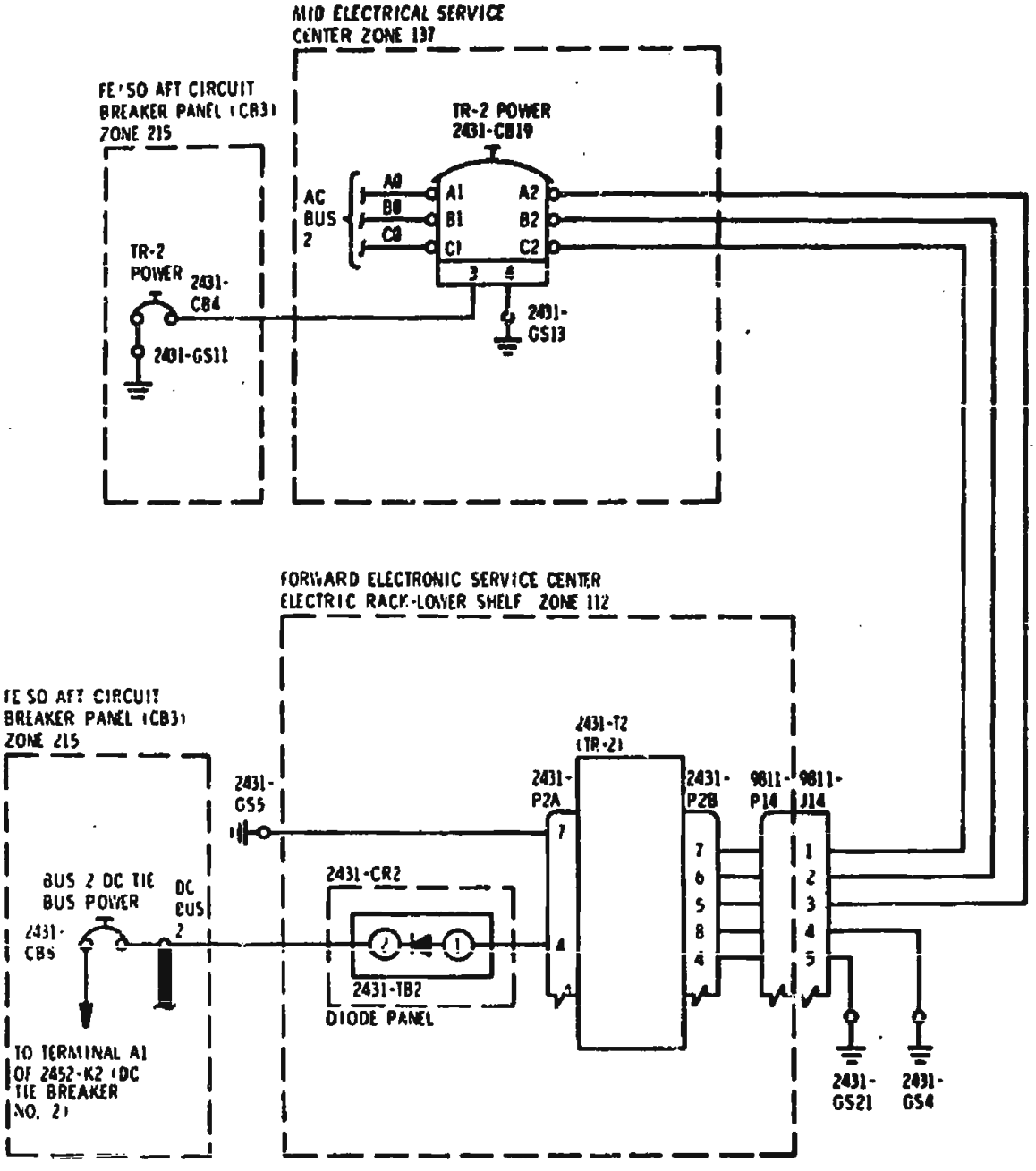


EM1-0000-24-2000

TR-1 System Schematic
SCHEM 1

DC BUS NO. 2 SHOWN
DC BUS NO. 3 TYPICAL

2

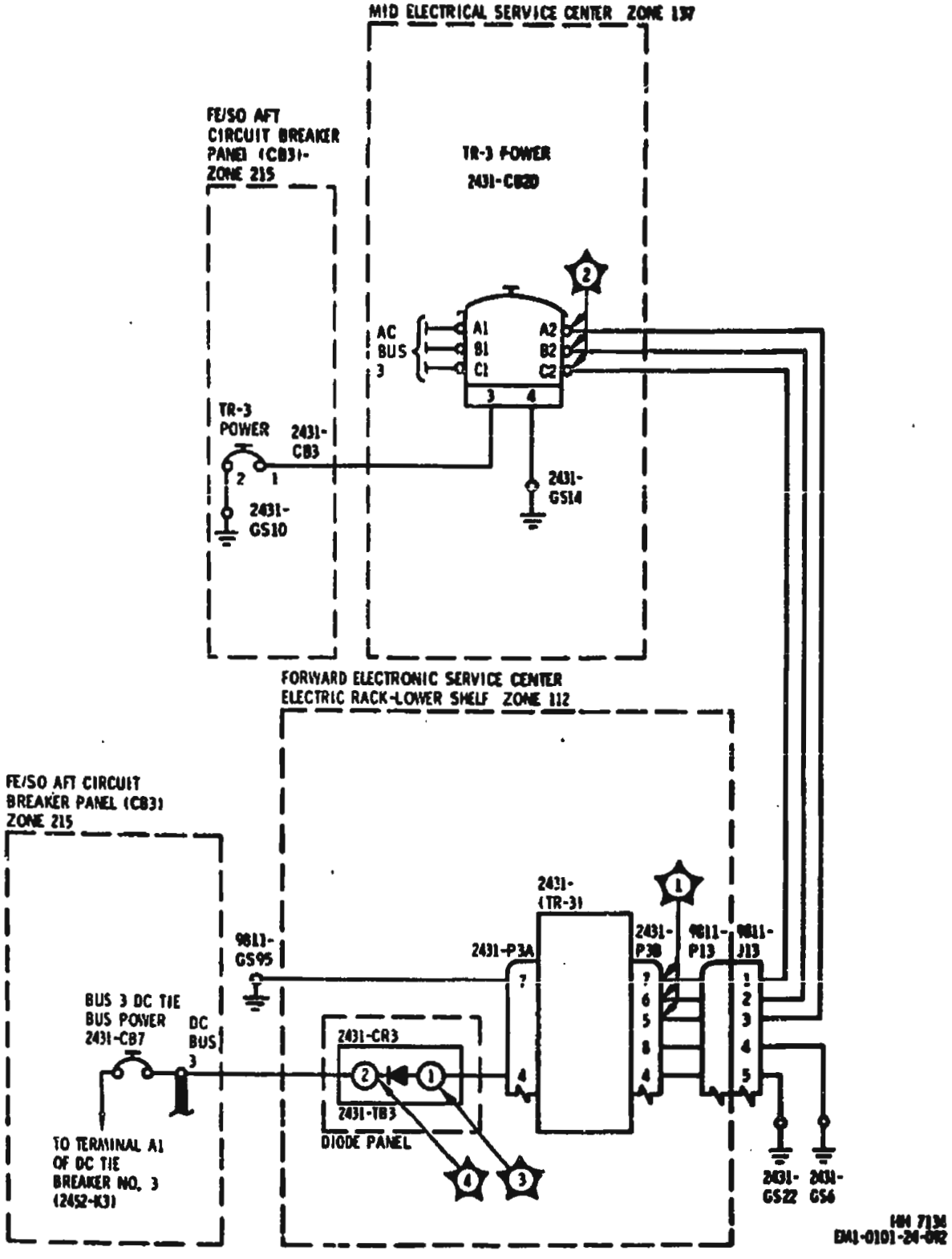


EMI-0009-24-091

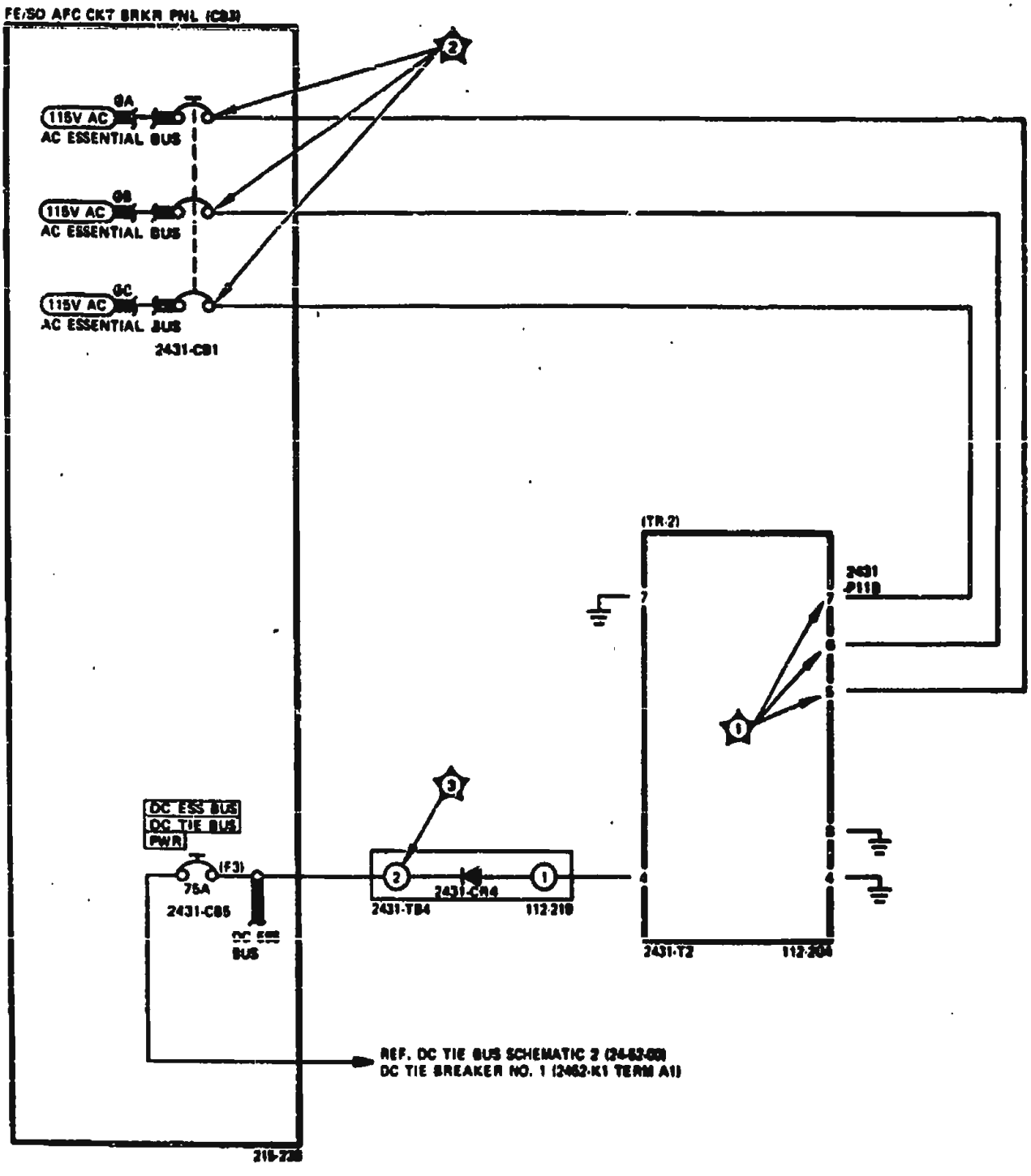
R TR-2/3 System Schematic
R SCHEM 2 (Sheet 1)

EFFECTIVITY: ALL

001B

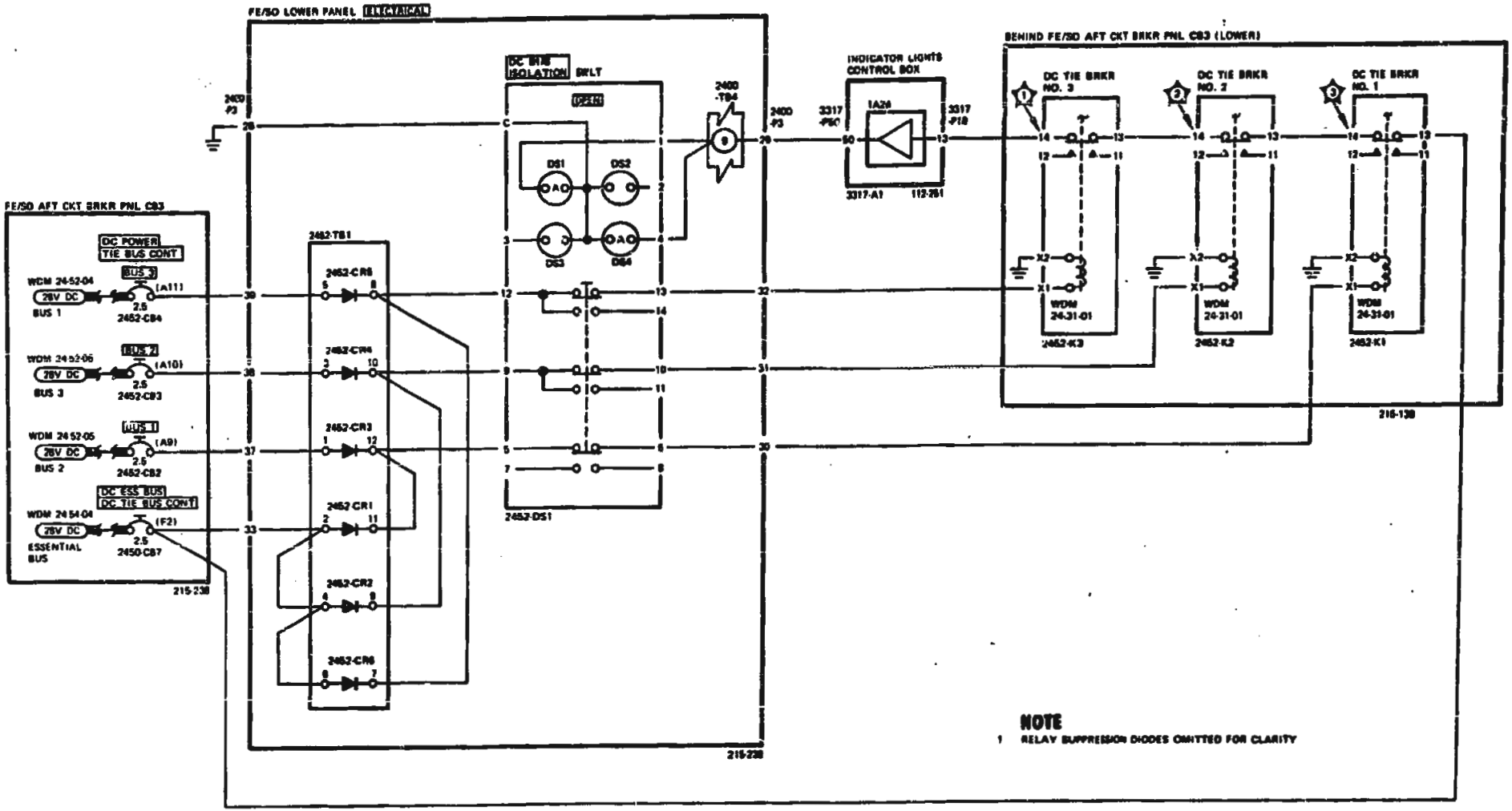


TR-2/3 System Schematic
SCHEM 2 (Sheet 2)



EM1-0108-24-003

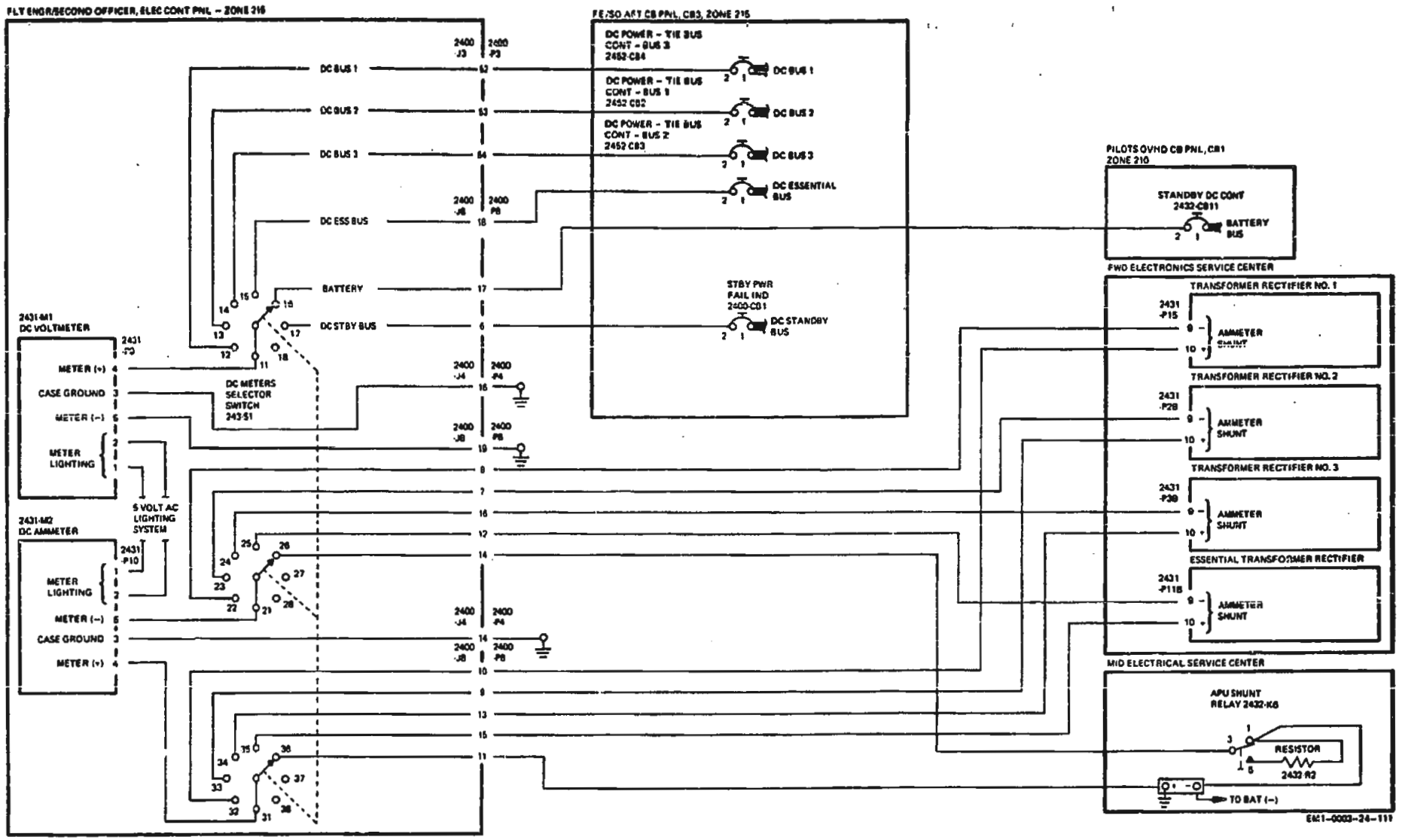
Essential TR Schematic
SCHEM 3



DC Bus Paralleling System Schematic
SCHEM 4

R
R
001B

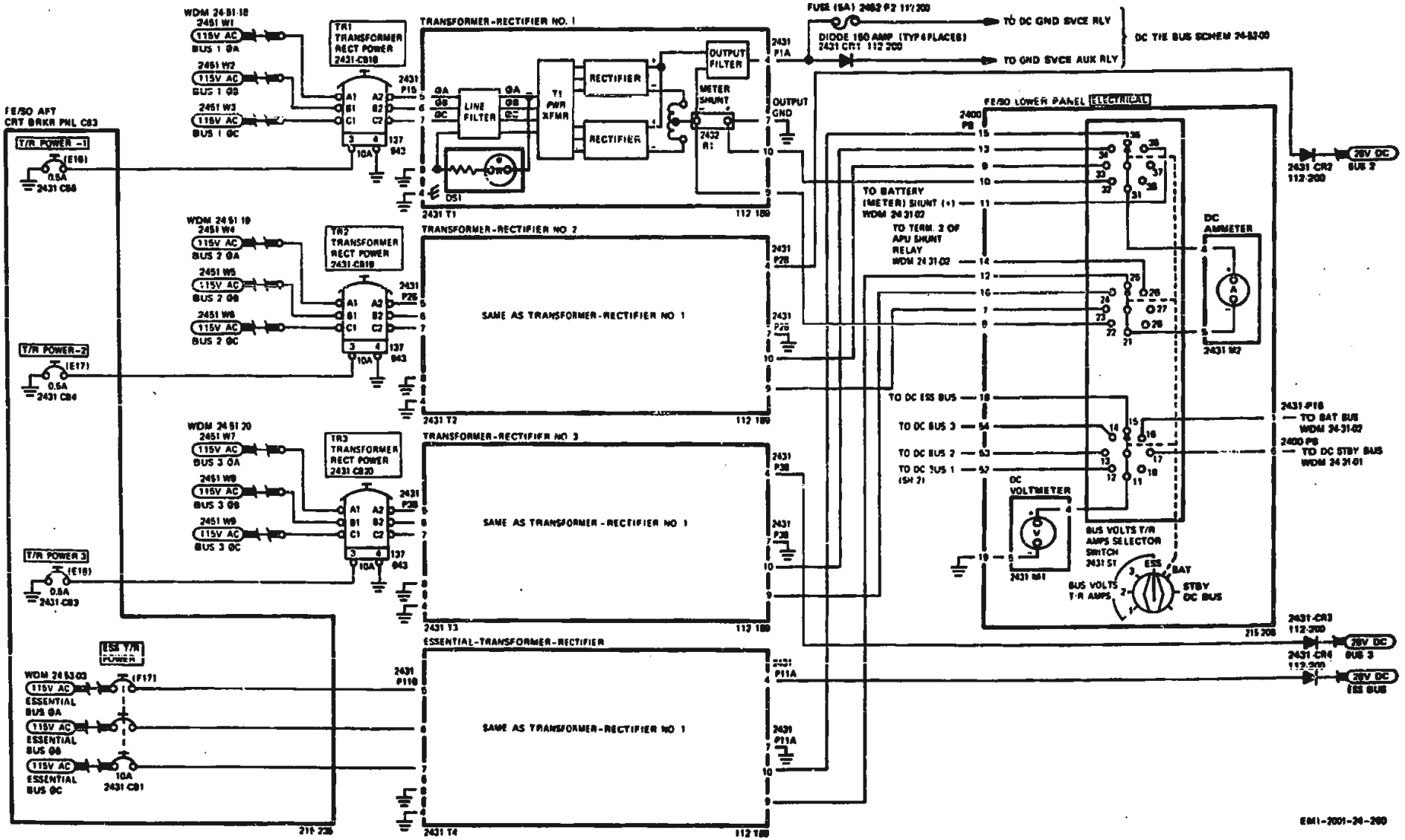
EFFECTIVITY: ALL



R DC Meters Indicating System Schematic
R SCHEM 5

EFFECTIVITY: ALL

001B



DC Power System Schematic
SCHEM 6

R

DC POWER SYSTEM - ADJUSTMENT AND TEST

1. Referenced Procedure

   24-00-00 Electrical Power - Maintenance Practices

2. Adjustment/Test

   A. Operational Test

      (1) On pilots overhead circuit breaker panel CB1, zone 210, verify circuit breakers ESS MASTER RADIO - CONT (B10) and PWR (B11) are closed.

      (2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify the following circuit breakers are closed:

      TIE BUS CONT

      BUS 1 (A9)

      BUS 2 (A10)

      BUS 3 (A11)

      TIE BUS PWR

      BUS 1 (A12)

      BUS 2 (A13)

      BUS 3 (A14)

      BUS 3 GALLEY POWER (A16).

      GND SVCE GALLEY EXT (A17)

      T/R POWER

      1 (E16)

      2 (E17)

      3 (E18)

      ESS T/R PWR (F17)

      DC ESS BUS

DC TIE BUS

CONT (F2)

PWR (F3)

MASTER RADIO

PWR (F4)

CONT (F5)

NO. 2 RADIO BUS

MASTER CONT (AA12)

DC (AA13)

CAUTION: DURING ROUTINE OPERATION OF DC SYSTEM, EACH OPERATING TRANSFORMER-RECTIFIER MUST BE FEEDING A LOAD OF AT LEAST 12 AMPERES.

NOTE: With the four transformer-rectifiers (TR) operating in parallel, the current output from TR-1, TR-2, TR-3, and the essential TR must not deviate more than ±7 amperes from the average.

CR
CR

(3) Turn on aircraft electrical system (Ref. 24-00-00).

(4) On Flight Engineer/Second Officers ELECTRICAL panel, zone 215, isolate dc buses by placing DC BUS ISOLATION switchlight in OPEN (latched-in) position. Verify that OPEN legend in switchlight comes on.

(5) On ELECTRICAL panel, place BUS VOLTS - T/R AMPS selector switch in position 1 and verify approximately 28 to 32 volts on adjacent DC VOLTS indicator.

(6) Repeat Step (5) for switch positions 2, 3, ESS, BAT, and STBY DC BUS.

(7) On ELECTRICAL panel, parallel dc buses by placing DC BUS ISOLATION switchlight in Closed (released) position. Verify OPEN legend in switchlight goes off.

(8) On ELECTRICAL panel, rotate BUS VOLTS - T/R AMPS selector switch to position 1, 2, 3, and ESS. Verify a minimum of 12 amperes current drain for each position whose corresponding transformer-rectifier is operating. Current is indicated on adjacent DC AMPS indicator.

(9) Verify equal load division between transformer-rectifiers as selector switch is rotated through position 1, 2, 3, and ESS. Maximum allowable load deviation is ±7 amperes from the average. If maximum is exceeded, perform the following:

CR
CR

(a) Isolate dc buses as noted in Step (4) and open circuit breaker corresponding to improperly operating transformer-rectifier.

CAUTION: BEFORE REMOVING TRANSFORMER-RECTIFIER, VERIFY CORRESPONDING CIRCUIT BREAKER ON FLIGHT ENGINEER/SECOND OFFICERS AFT CIRCUIT BREAKER PANEL CB3, IS OPEN AND TAGGED.

(b) Remove transformer-rectifier, reparallel dc buses as noted in Step (7), and measure reverse current from pin 4 of upper receptacle to ground. If current flow exceeds 20 milliamperes, replace corresponding blocking diode.

(c) If reverse current flow is not excessive, replace transformer-rectifier with one of the other 3 units; close breakers and verify that load deviation transfers with transformer-rectifier to new channel. If so, replace transformer-rectifier. If no change is evident in load deviation, initiate appropriate transformer-rectifier system fault isolation procedures.

(10) Turn off aircraft electrical system (Ref. 24-00-00).

TRANSFORMER-RECTIFIER - REMOVAL AND INSTALLATION

1. Referenced Procedure

20-23-02	Rack Mounted ARINC Box Lever Latch - Maintenance Practices
24-41-00	External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breaker ESS PWR or AC POWER - T/R POWER 1, 2, or 3.

(2) Open the forward electronic service center [illegible]or 112AB for access to transformer-rectifiers (TR)

R WARNING: HIGH VOLTAGES IN THIS AREA CAN BE FATAL.

(3) Locate applicable TR in electrical rack (to right of door), and release Camloc handle (Ref. Fig. 401).

(4) Remove TR by pulling from rack to disengage electrical connector.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

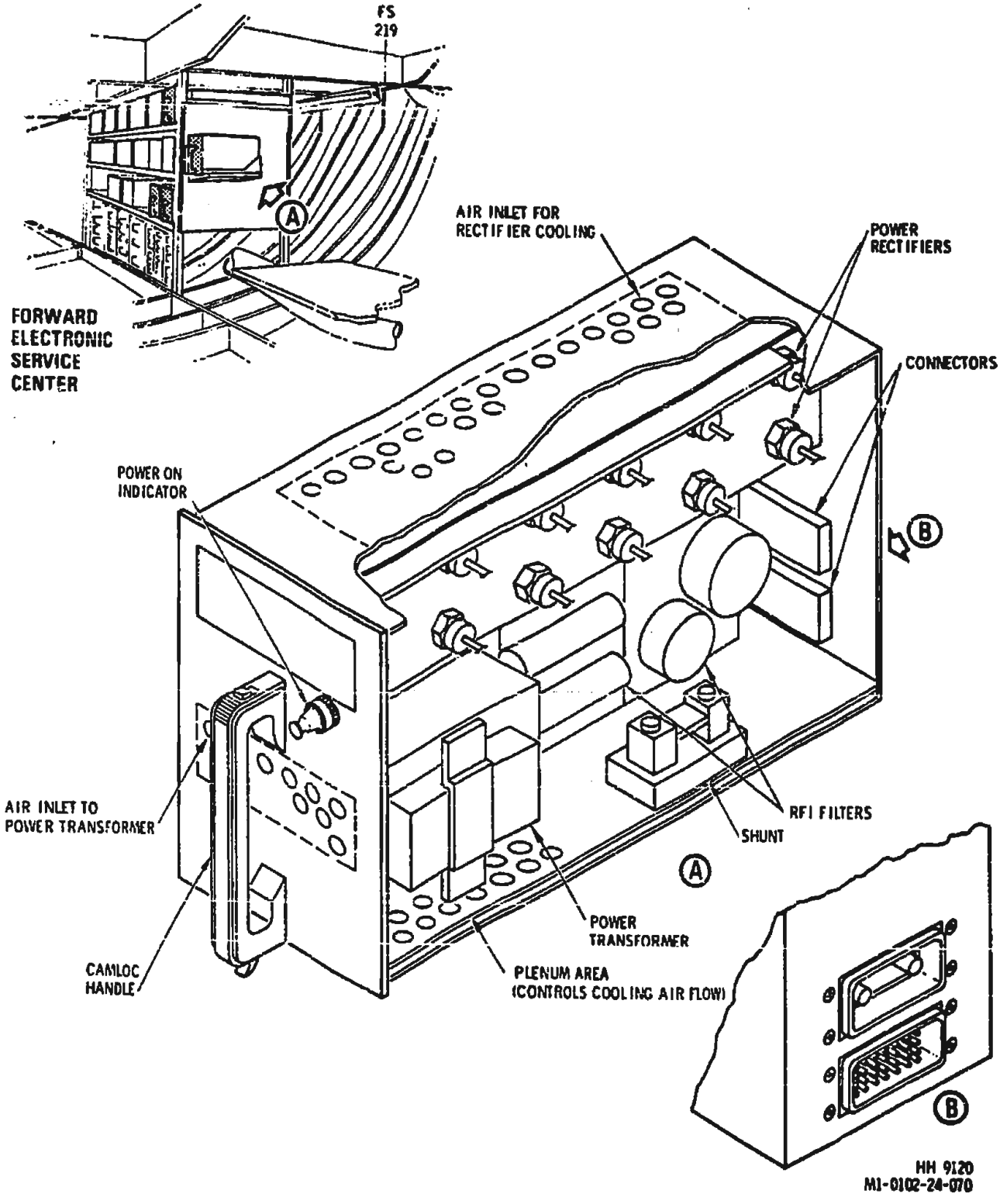
(2) Insert TR into space in rack (connector end first) and engage latch (Ref. 20-23-02).

(3) Remove tag and close circuit breaker opened in Step 2A(1).

R WARNING: BEFORE ENERGIZING ELECTRICAL SYSTEM, ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED. HIGH VOLTAGES CAN BE FATAL.

(4) Energize ac bus system (Ref. 24-41-00).

(5) On Flight Engineer/Second Officers electrical control panel, zone 215, check TR operation as follows:



R R 75-Amp Transformer-Rectifier - Removal and Installation
Figure 401

(a) Depress (latched in) DC BUS ISOLATION switchlight. The OPEN legend will come on.

(b) Select applicable TR on BUS VOLTS T/R AMPS selector switch and ensure that bus voltage is 26 volts (nominal) with any load from 10 to 75 amps indicated on adjacent voltmeter and ammeter.

(c) Return DC BUS ISOLATION switchlight to normal (out) position.

(6) Deenergize ac bus system (Ref. 24-41-00).

(7) Close and secure service center door.

DC VOLTMETER LAMP - SERVICING

1. Referenced Procedure

   24-00-00 Electrical Power - Maintenance Practices

2. Servicing

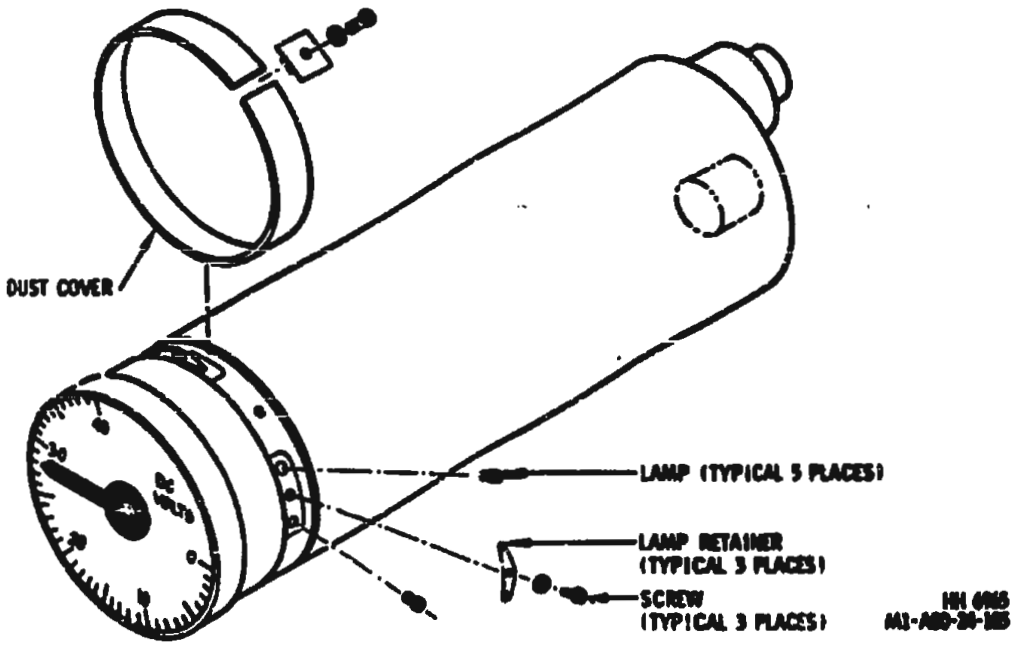
   A. DC Voltmeter Lamp Replacement

      (1) Loosen retainer screw next to meter and pull meter out approximately 3 inches. Tighten retainer screw to hold meter while replacing lamps.

      (2) Remove dust cover by removing screw and cover retainer (Ref. Fig. 301). Slide dust cover back to expose lamp retainers.

      (3) Remove screw holding lamp retainer and remove lamp.

      (4) Install new lamp, retainer, and screw.



DC Voltmeter Lamp Removal and Replacement
Figure 301

(5) Slide dust cover into place and secure with retainer and screw.

(6) Loosen retainer screw next to meter and push meter back into proper position. Tighten retainer screw after ensuring that meter has been rotated to proper position.

(7) Ensure that electrical system is energized (Ref. 24-00-00).

(8) Ensure that the following circuit breakers are closed:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: F/E INSTR

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215: FLT ENGR INSTRUMENT PANEL - LOWER LEFT

(9) Rotate INSTR LIGHTS control on Flight Engineer/Second Officers lower panel, zone 215, from OFF to BRT and check that meter lights come on. Place control in OFF position.

(10) Deenergize electrical system (Ref. 24-00-00).

DC AMMETER LAMP - SERVICING

1. Referenced Procedure

   24-00-00 Electrical Power - Maintenance Practices

2. Servicing

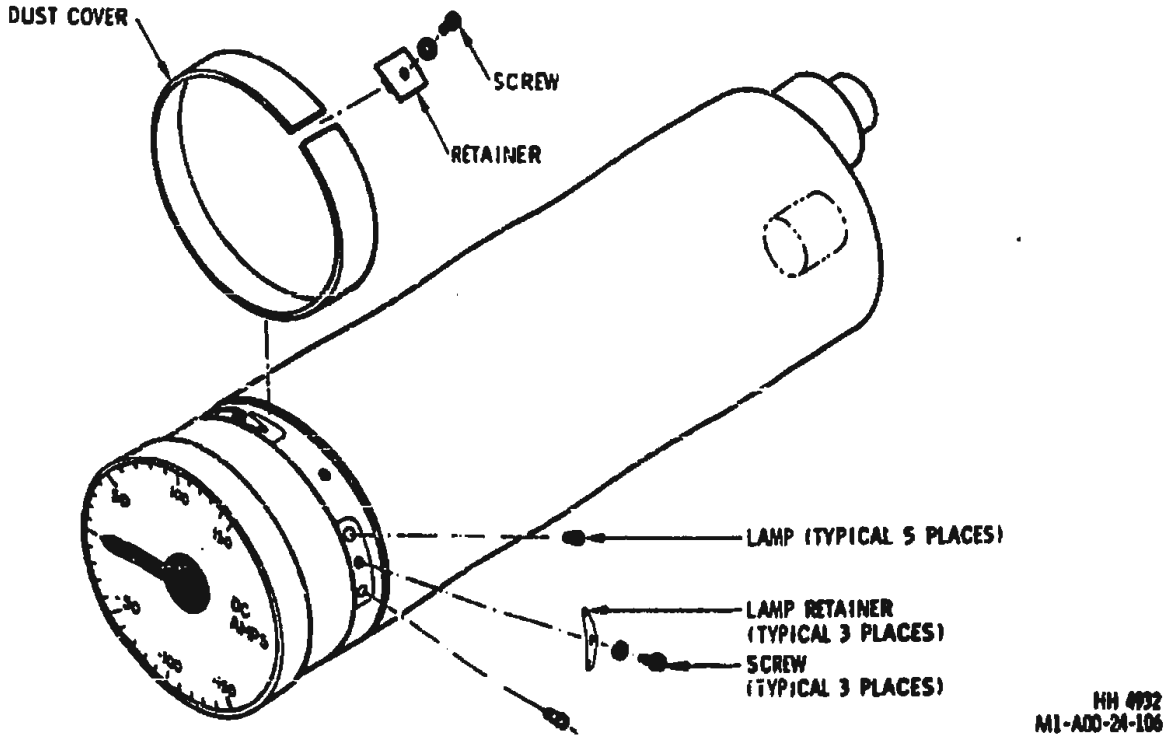
   A. DC Ammeter Lamp Replacement

      (1) Loosen retainer screw next to meter and pull meter out approximately 3 inches. Tighten retainer screw to hold meter while replacing lamps.

      (2) Remove dust cover by removing screw and cover retainer (Ref. Fig. 301). Slide dust cover back to expose lamp retainers.

      (3) Remove screw holding lamp retainer and remove lamp.

      (4) Install new lamp, retainer, and screw.



R R DC Ammeter Lamp Removal and Replacement
Figure 301

(5) Slide dust cover into place and secure with retainer and screw.

(6) Loosen retainer screw next to meter and push meter back into proper position. Tighten retainer screw after ensuring that meter has been rotated to proper position.

(7) Ensure that electrical system is turned on (Ref. 24-00-00).

(8) Ensure that the following circuit breakers are closed:

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215: F/E INSTR

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215: FLT ENGR INSTRUMENT PANEL - LOWER LEFT

(9) Rotate INSTR LIGHTS control on Flight Engineer/Second Officers lower panel, zone 215, from OFF to BRT and check that meter lights come on. Place control in OFF position.

(10) Turn off electrical system (Ref. 24-00-00).

POWER DIODE - REMOVAL AND INSTALLATION

1. Referenced Procedures

24-41-00 External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3 zone 215, open and tag circuit breakers ESS PWR (F17) - T/R POWER 1(E16), 2(E17), 3(E18).

(2) Open the forward electronic service center door 112AB for access to FESC.

WARNING: HIGH VOLTAGES IN THIS AREA CAN BE FATAL.

(3) Locate aft end of right hand electrical rack and remove top perforated panel for access (Ref. Fig. 401).

CAUTION: DAMAGE TO DIODE CAN RESULT FROM TWISTING PIGTAIL LEAD IF DIODE IS NOT HELD WHEN REMOVING DIODE MOUNTING NUT.

(4) Remove applicable button plug and insert ratchet extender through button plug hole to remove diode mounting nut.

(5) Unfasten pigtail and remove diode.

B. Installation

R (1) Place diode in heat sink and tighten mounting nut to
R 120-150 inch-pounds.

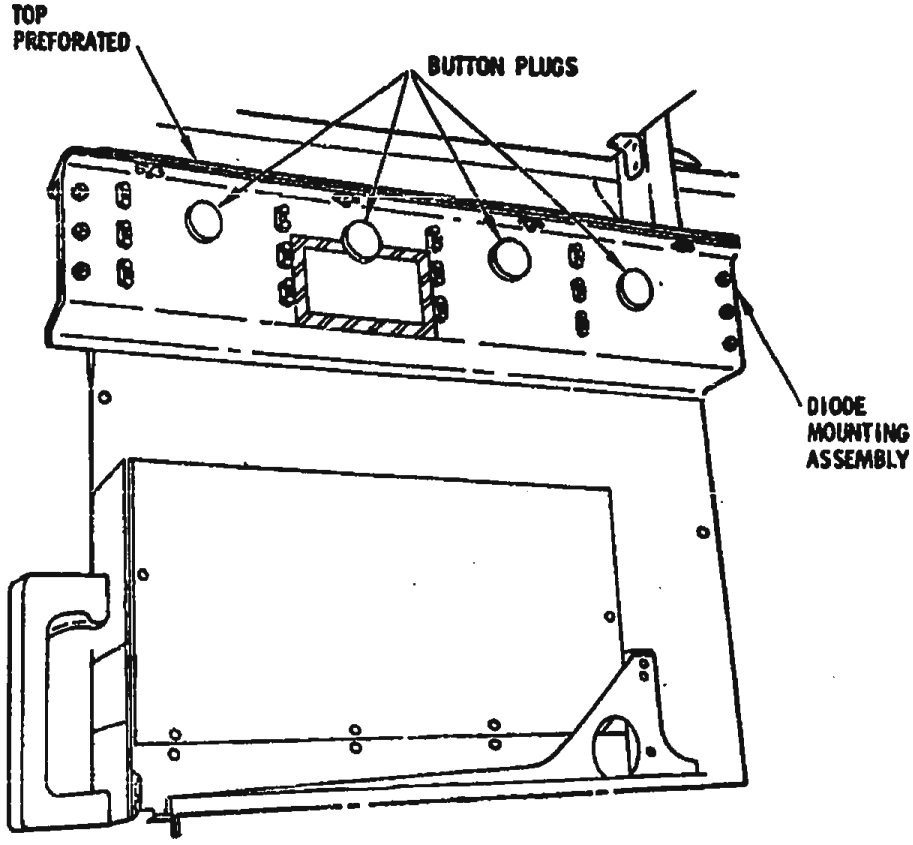
(2) Connect diode pigtail to terminal.

(3) Replace perforated panel and button plug.

(4) Remove tag and close circuit breakers opened in Step 2A(1).

(5) Perform DC Power System Adjustment and Test.

(6) Turn off electrical power (Ref. 24-41-00).



M1-0100-24-567

R Power Diode Removal
R Figure 401

R EFFECTIVITY: ALL
R
001B

STANDBY POWER SYSTEM - DESCRIPTION AND OPERATION

1. General

The standby power system provides 115V, single-phase ac and 26V dc standby power to energize essential flight and engine starting instruments, navigation, communication, lighting systems, and the engine air-start system whenever such power is not available from the normal sources.

The system includes a 26-volt nickel-cadmium battery, a battery charger, and a solid-state 115-volt single-phase inverter. The battery and inverter will supply power to the essential systems for a minimum of 40 minutes. Power available is sufficient to make engine start attempts for a total of 6 minutes. The start attempts may be made simultaneously on all three engines if required. The battery, in addition to energizing the inverter, is used to start the APU.

The standby power system is controlled by a three-position guarded switch located in the flight station on the eyebrow panel, zone 210. System status is indicated by lights on the eybrow panel and on the(FE/SO) electrical control panel, zone 215, and on the pilots caution and warning panel.

Standby power system components located in the flight station, zones 210 and 215, (Ref. Fig. 1 and 2) are:

AC standby bus (single-phase)

AC standby bus sensing relay

AC standby transfer relay

Battery bus extension

BATTERY switch

R Battery Charger Mode Select Switch

Battery Bus Extension Current Level Time Delay Relay

Battery Bus Extension DC Current Level Detector

DC essential bus sensing relay

DC standby bus

DC standby bus sensing relay

DC standby bus transfer relay

Engine start bus

Engine start bus relay

Engine start bus sensing relay

Inverter control relay

STANDBY POWER INSTR & RADIO switch

Indicator Lights:

AC STBY BUS FAIL

DC STBY BUS FAIL

ESS/STBY POWER

ELECTRICAL SYSTEM

STBY PWR ON

STBY PWR flowbar (horizontal light bar)

Standby power UNARM

BATTERY CONDITION

Standby power system components located in the mid electrical service center, zone 137, are:

26-volt nickel-cadmium battery

Battery bus

Battery shunt

Battery charger

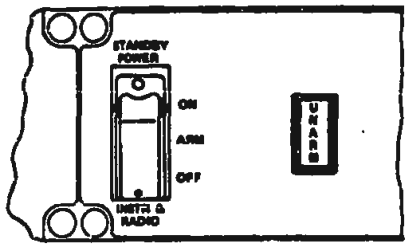
Battery charger relay

Battery charger control relay

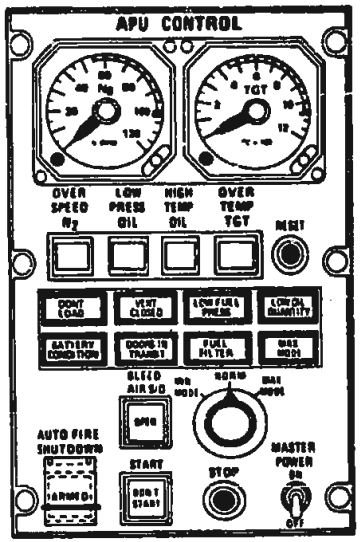
APU shunt relay

115-volt, 750-Voltampere static inverter

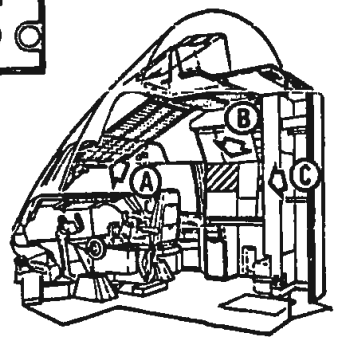
Inverter relay

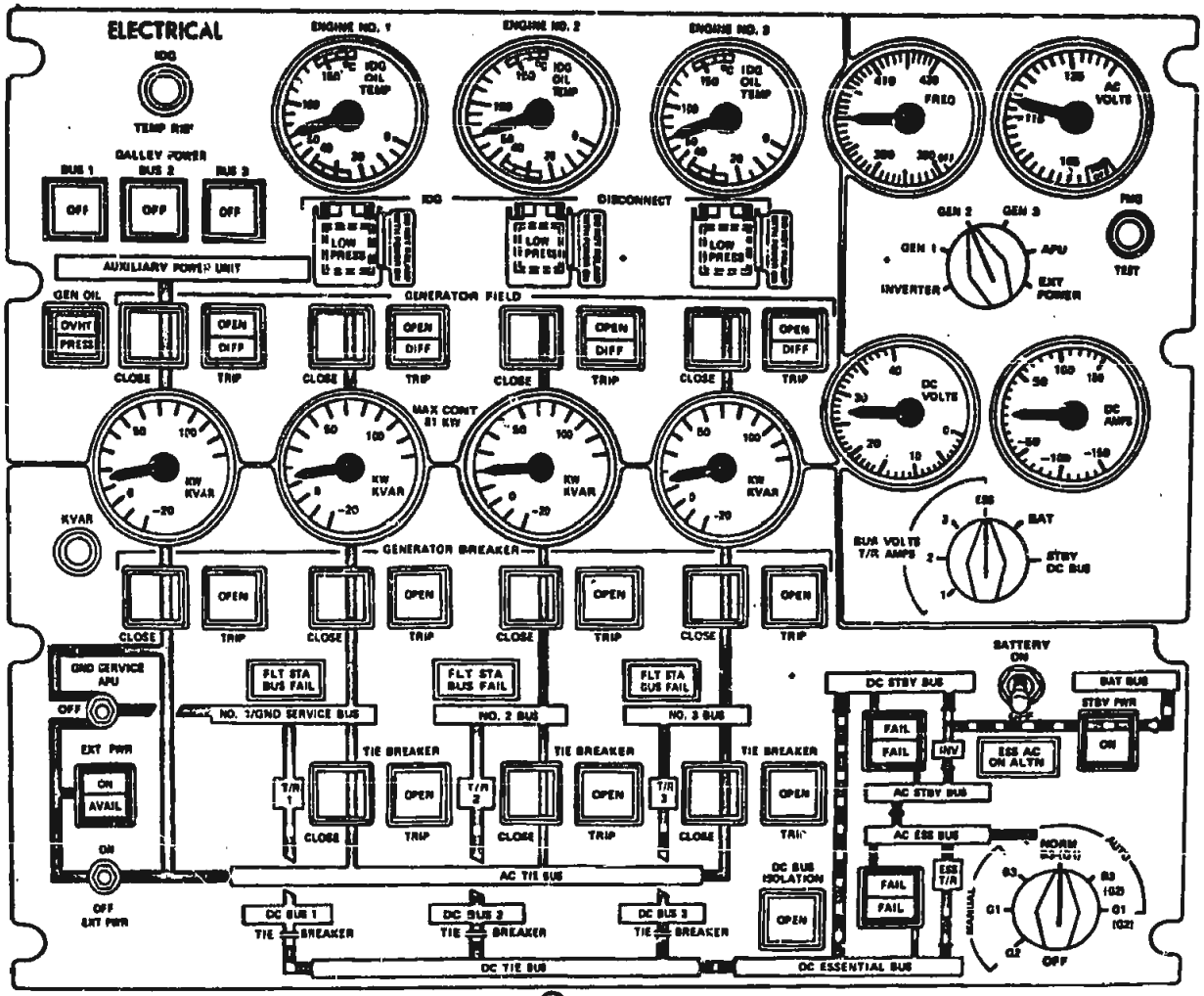


Ⓐ
PILOTS EYEBROW PANEL



Ⓒ
APU CONTROL PANEL





Ⓑ
ELECTRICAL CONTROL PANEL

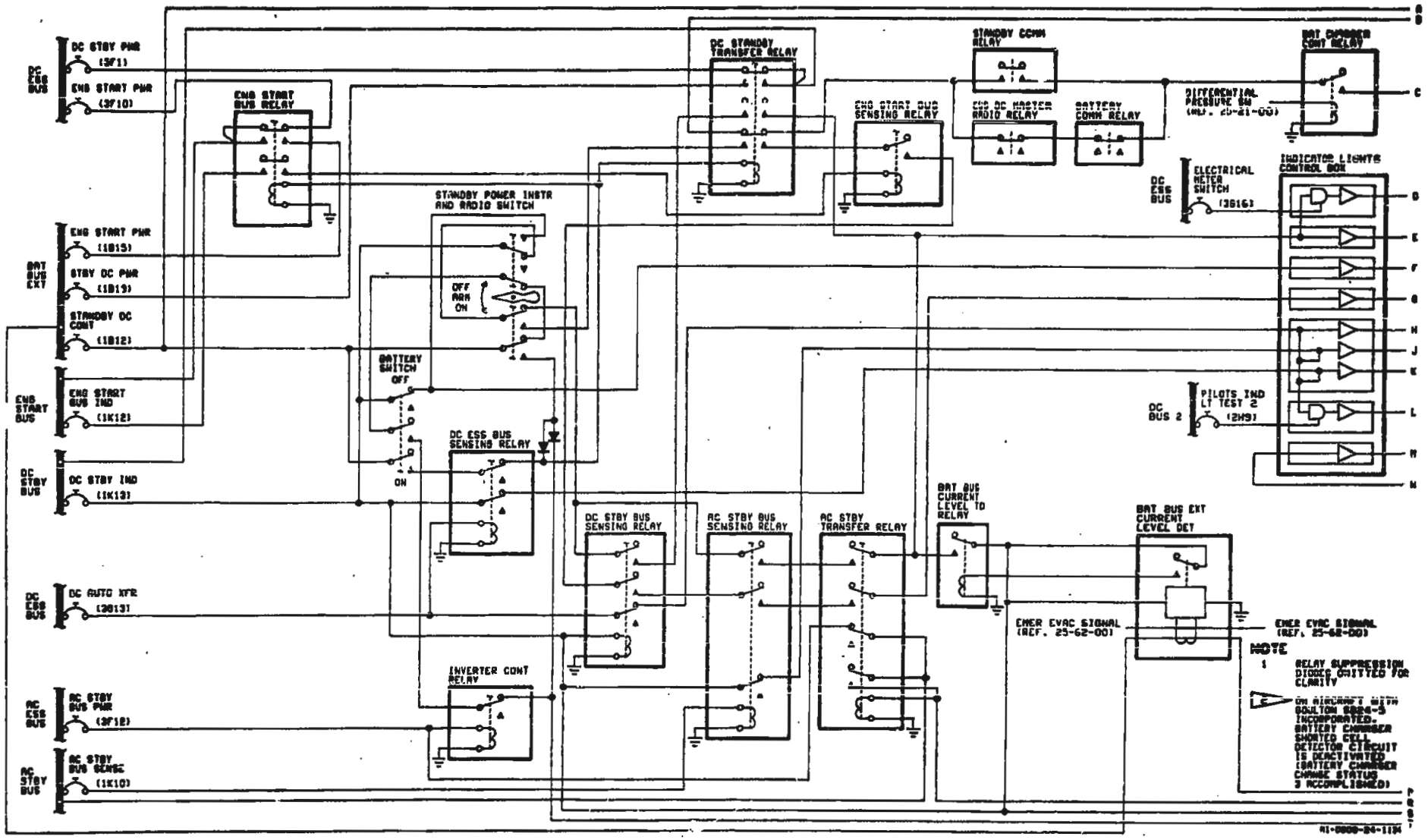
CODE
AC
DC

MI-6000-24-107

R
R Electrical Power System Controls and Indicators
Figure 1

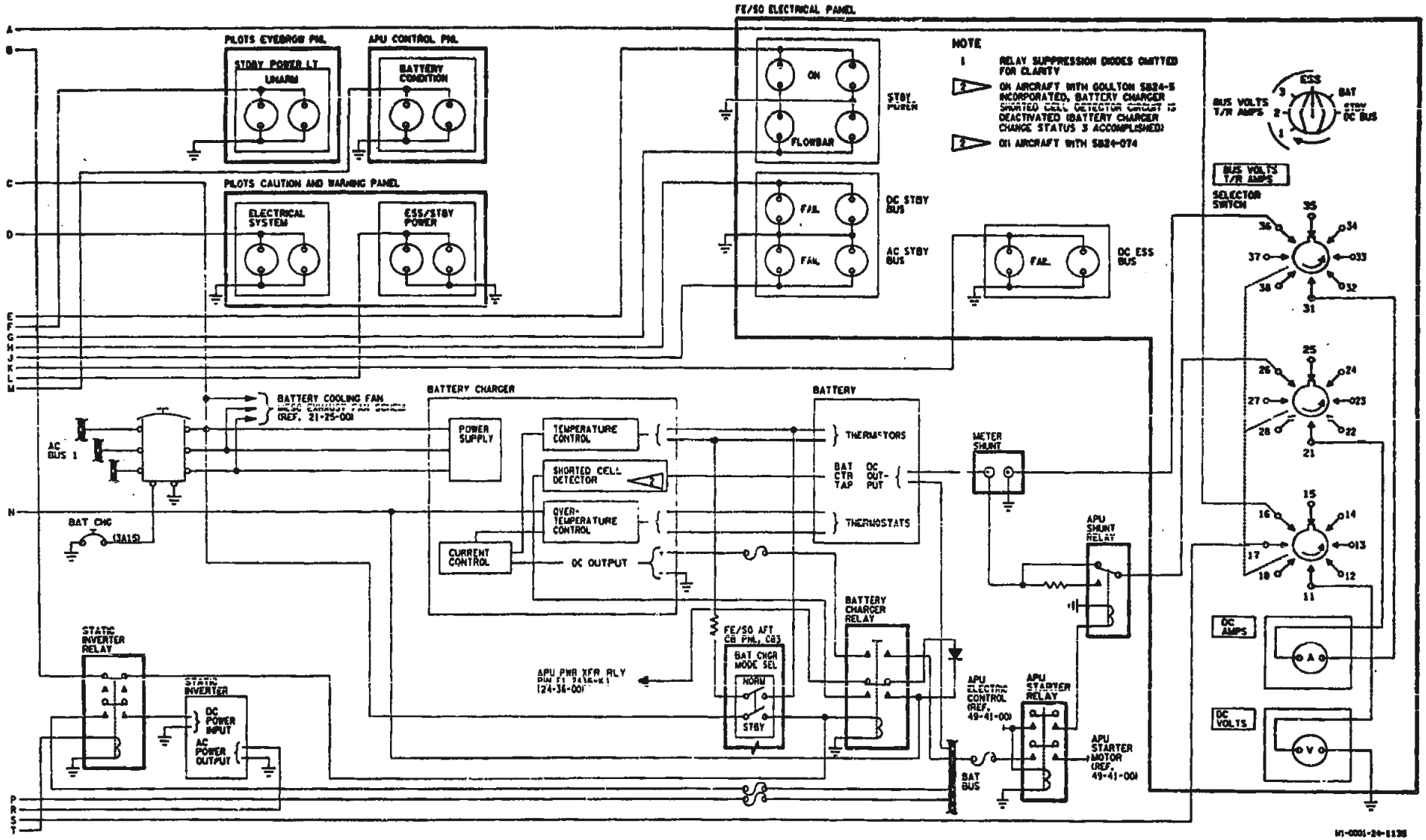
EFFECTIVITY: ALL

001B


DC STBY PWR (3F1)
ENG START PWR (3F10)
DC ESS BUS
ENG START BUS RELAY
DC STANDBY TRANSFER RELAY
ENG START BUS SENSING RELAY
STANDBY COMM RELAY
ENG DC MASTER RADIO RELAY
BATTERY CONN RELAY
BAT CHARGER CONT RELAY
DIFFERENTIAL PRESSURE SW (MLG, 25-21-00)
INDICATOR LIGHTS CONTROL BOX
DC ESS BUS
ELECTRICAL METER SWITCH (3G16)
STANDBY POWER INSTR AND RADIO SWITCH
OFF ARM ON
ENG START PWR (1B15)
STBY DC PWR (1B19)
BAT BUS EXT
STANDBY DC CONT (1B12)
BATTERY SWITCH OFF
ON
ENG START BUS
ENG START BUS IND (1K12)
DC ESS BUS SENSING RELAY
DC STBY BUS
DC STBY IND (1K13)
DC STBY BUS SENSING RELAY
AC STBY BUS SENSING RELAY
AC STBY TRANSFER RELAY
BAT BUS CURRENT LEVEL TD RELAY
BAT BUS EXT CURRENT LEVEL DET
DC BUS 2
PILOTS IND LT TEST 2 (2H9)
DC ESS BUS
DC AUTO XFR (3G13)
EMER EVAC SIGNAL (REF. 25-62-00)
EMER EVAC SIGNAL (REF. 25-62-00)
INVERTER CONT RELAY
AC ESS BUS
AC STBY BUS PWR (3F12)
AC STBY BUS
AC STBY BUS SENS. (1K10)
NOTE
1 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
ON AIRCRAFT WITH BOULTON 8824-5 INCORPORATED, BATTERY CHARGER SHORTED CELL DETECTOR CIRCUIT IS DEACTIVATED (BATTERY CHARGER CHANGE STATUS 3 ACCOMPLISHED)

C C Standby Power System Schematic
Figure 2 (Sheet 1)

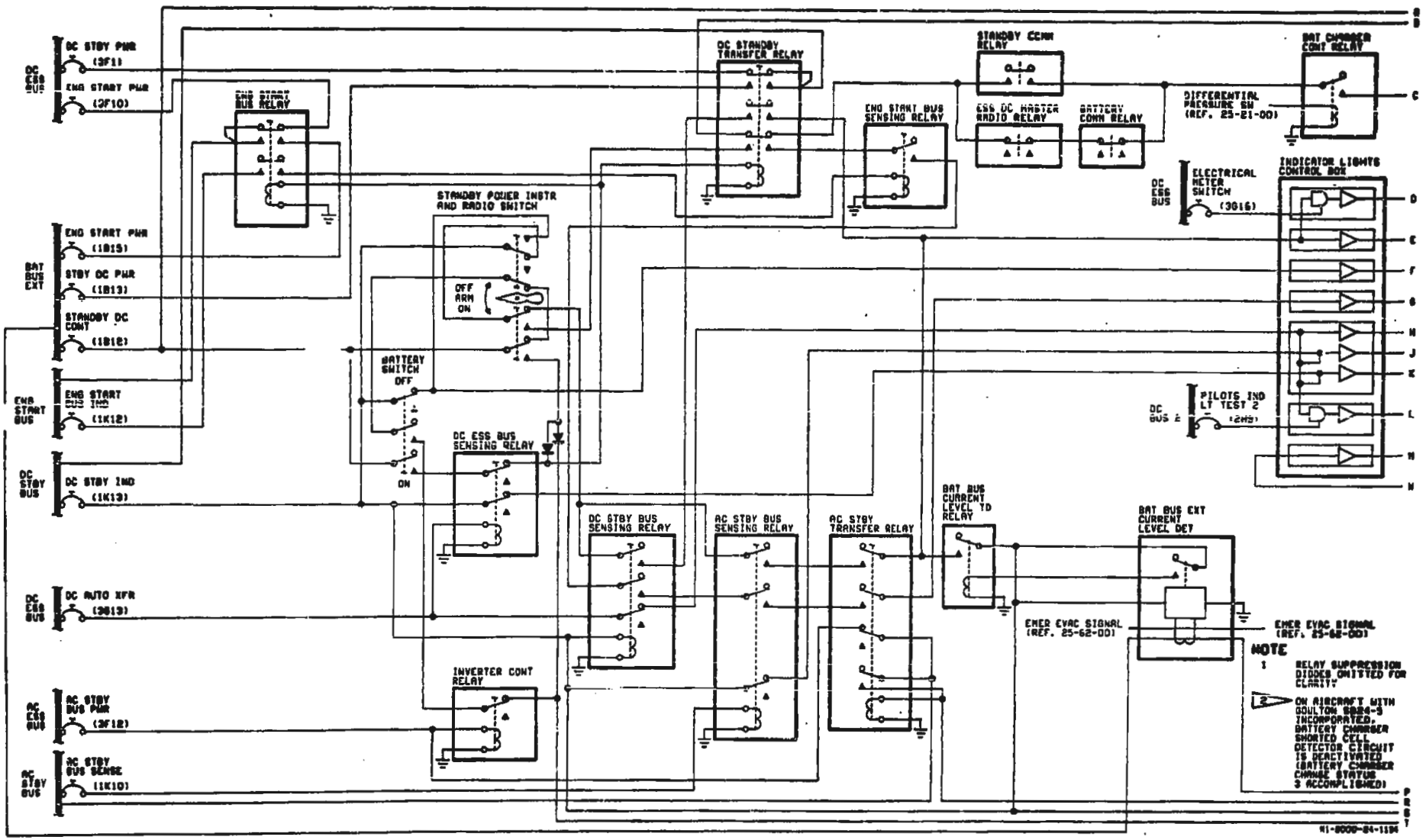
R R 001B EFFECTIVITY: 001-031



Standby Power System Schematic
Figure 2 (Sheet 2)

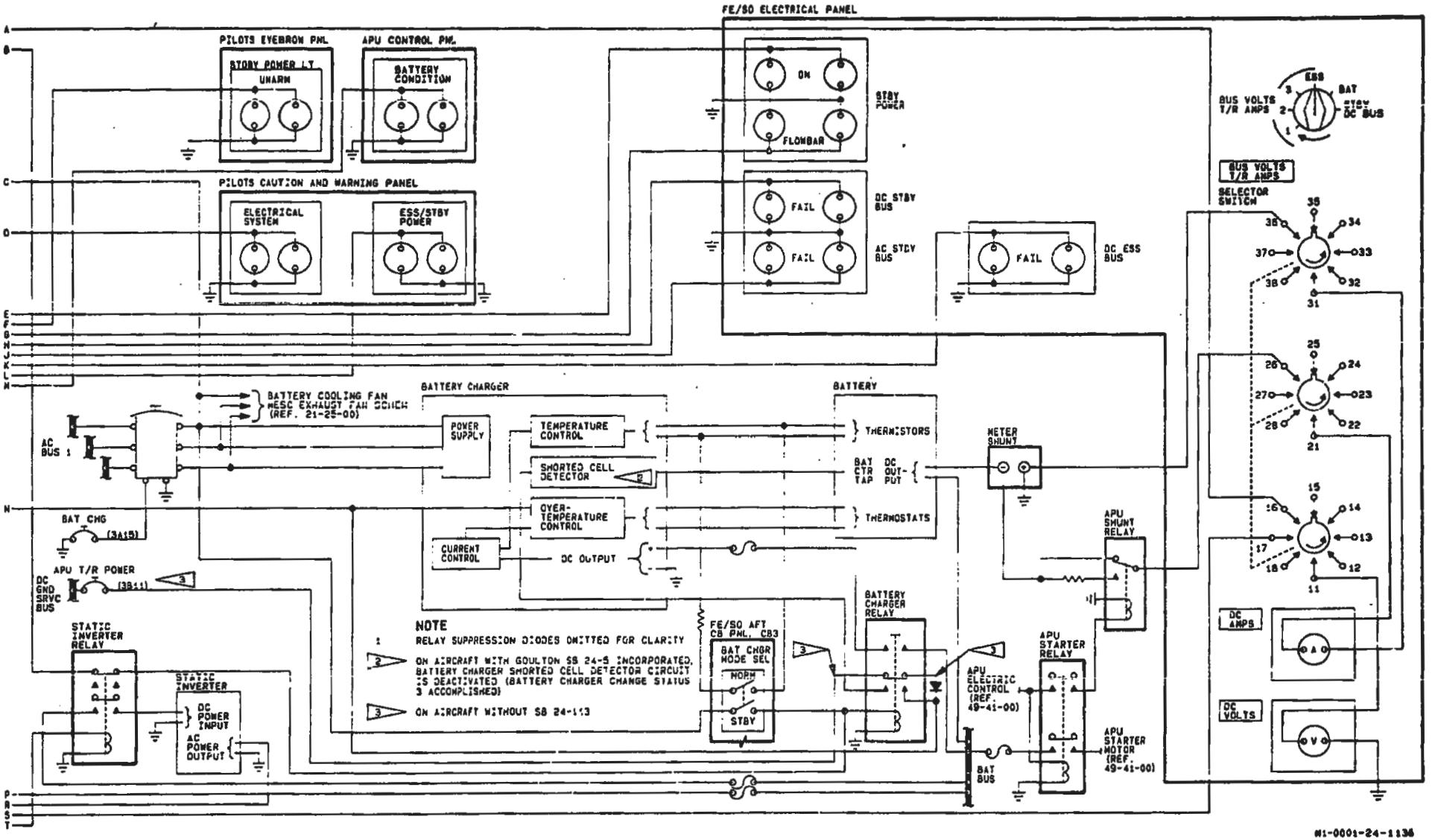
EFFECTIVITY: 001-031

001B



Standby Power System Schematic
Figure 2 (Sheet 1)

EFFECTIVITY: 032-999



M1-0001-24-1136

CR Standby Power System Schematic
CR Figure 2 (Sheet 2)

EFFECTIVITY: 032-999

001B

The battery bus and its flight station extension are energized directly from the battery under all conditions. The battery is charged by the battery charger, as required, whenever ac power is available on the energizing bus, the standby power system is not energized from the battery (Ref. Fig. 3) and the Battery Charger Mode switch is in the NORM position. The charging voltage, with the Battery Charger Mode switch in the NORM position, is higher than the normal battery voltage (as high as 38 volts); therefore, the charger output is disconnected from the battery whenever the battery is being used as the standby power source.

If one of the standby bus transfer relays becomes frozen in the standby position, which could deplete the battery before the end of the flight, the battery charger can be used as a standby power source in parallel with the battery. When the Battery Charger Mode switch is in the STBY position, the battery charger interlocks are bypassed and the charger output is reduced so that the maximum battery bus voltage does not exceed 30 volts. This allows the flight to be completed without loss of power to the battery bus or standby busses.

The battery charger senses the voltage and temperature of the battery, and provides the necessary charging current to maintain the battery fully charged. The BATTERY CONDITION (caution) light is located on the APU control panel, zone 215. The light receives a signal from the charger and comes on to indicate a battery overtemperature condition or a shorted cell. Either of these conditions requires attention prior to the next flight. The light is located on the APU control panel because these conditions are most likely to become apparent during the APU start. An APU start must not be attempted if the battery is faulty.

The battery charger is energized through a three-phase remote controlled circuit breaker (RCCB) from ac bus 1. Charger output is connected to the battery by actuation of the battery charger control relay. The relay is actuated by a differential pressure across the mid electrical service center exhaust fan (Ref. 21-25-00). The charger control relay will not allow the charger to charge the battery if there is insufficient ventilation airflow.

The dc standby bus is energized either from the dc essential bus (normal) or the battery bus (automatic or manual transfer). Automatic transfer occurs if the dc essential bus becomes deenergized and the BATTERY switch on the FE/SO electrical control panel, zone 215, is in the ON position. Manual transfer is controlled by the STANDBY POWER INSTR & RADIO switch on the eyebrow panel, zone 210. With the switch in the ON position, the bus will transfer even with the BATTERY switch in the OFF position.

The single-phase ac standby bus is normally energized from phase A of the ac essential bus. The bus may be transferred either automatically or manually to the static inverter. Automatic transfer will occur with loss of power on the ac essential bus provided the BATTERY switch is in the ON position and the STANDBY POWER INSTR & RADIO switch is in the ARM position. Manual transfer occurs when the STANDBY POWER INSTR & RADIO switch is placed in the ON position. In a manual transfer mode, both the ac and dc standby buses will be powered from the standby sources even if the essential buses are energized. Automatic transfer of the ac standby bus may be prevented by placing the STANDBY POWER INSTR & RADIO switch in the OFF position.

2. Operation

A. Manual Operation

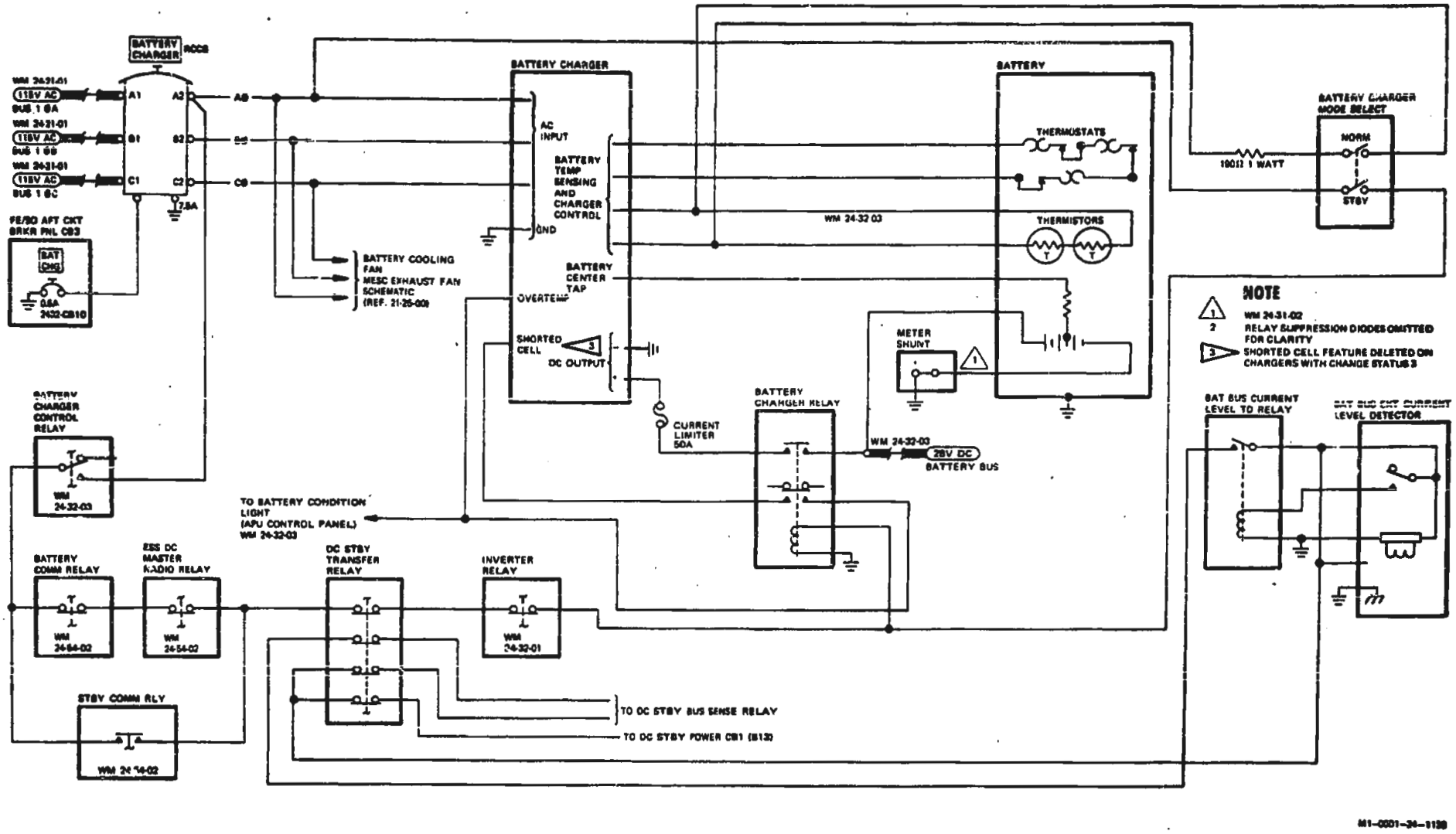
Manual control of the standby power system is provided by the STANDBY POWER INSTR & RADIO switch and the BATTERY switch (Ref. Fig. 1).

The STANDBY POWER INSTR & RADIO switch has three positions: OFF-ARM-ON. The switch will normally be in the guarded ARM position in flight. When the switch is placed in the OFF position, the inverter relay control circuit is disabled (Ref. Fig. 2). The disabled circuit prevents automatic operation of the ac standby bus transfer, even though all other conditions call for it. The standby power UNARM light is located adjacent to the STANDBY POWER INSTR & RADIO switch. When either the BATTERY switch or the STANDBY POWER INSTR & RADIO switch is in the OFF position the light comes on to indicate that the automatic transfer system is inoperative.

When the STANDBY POWER INSTR & RADIO switch is placed in the ON position, the dc standby transfer relay and the static inverter relay are energized directly from the battery bus. The energized transfer relay disables the battery charger relay, energizes part of the standby power override light bar circuit, and transfers the dc standby bus from the dc essential to the battery bus.

The energized inverter relay provides a second disabling point for the battery charger relay and energizes the inverter from the battery bus.

The inverter output energizes the ac standby transfer relay, which transfers the ac standby bus from the ac essential bus to the inverter output. The relay also enables a second section of the STBY PWR ON light circuit. Contacts of the



C C Battery Charger and Relay Control Functional Diagram
Figure 3

R R 001B EFFECTIVITY: ALL

ac standby transfer relay are in series with contacts of the two standby bus sensing relays and the dc standby transfer relay. If both transfer relays are energized and power is on both buses, the STBY PWR flowbar light comes on. The lighted bar confirms that the standby system has transferred.

The above conditions are true even if normal power is on the essential buses, and regardless of the position of the BATTERY switch.

The BATTERY switch has two positions: ON-OFF. With the BATTERY switch in the OFF position, the automatic transfer of both the ac and dc standby buses is disabled. The standby power UNARM light comes on when the BATTERY switch is in the OFF position, provided the dc standby bus is energized. Placing the BATTERY switch in the ON position enables the automatic transfer circuits for the dc standby bus.

B. Automatic Operation

With the BATTERY switch in the ON position and the STANDBY POWER INSTR & RADIO switch in the ARM position, the automatic transfer system is ready to operate. As long as the dc essential bus is energized, the dc essential bus sensing relay will be energized. The relay opens the circuit to the dc standby transfer relay coil. If the dc essential bus deenergizes, the sensing relay deenergizes and completes the circuit from the battery bus, through the BATTERY switch, to the dc standby transfer relay coil. The relay energizes and transfers the dc standby bus to the battery bus in the same manner as described in the manual operation section.

If the ac essential bus deenergizes, the inverter control relay deenergizes and completes the circuit from the battery bus, through the standby power and battery switches, to the inverter relay coil. The closed contacts of the inverter relay connect battery bus power to the static inverter. The action from this point is the same as in the manual operation.

The ac and dc standby bus FAIL lights come on if their respective buses are deenergized. The ESS/STBY POWER legends on the pilots caution and warning panel, zone 210, is on when the standby bus system is automatically transferred, or when a standby or essential bus is deenergized.

3. Static Inverter

A. Description and Operation

The static inverter (Ref. Fig. 4) is a solid-state device which converts a nominal 28V dc to a nominal 115V, 400-Hz, 750-voltampere, single-phase ac output. The inverter is in a standard 3/4 ATR size case, rack-mounted in the mid electrical service center, zone 137.

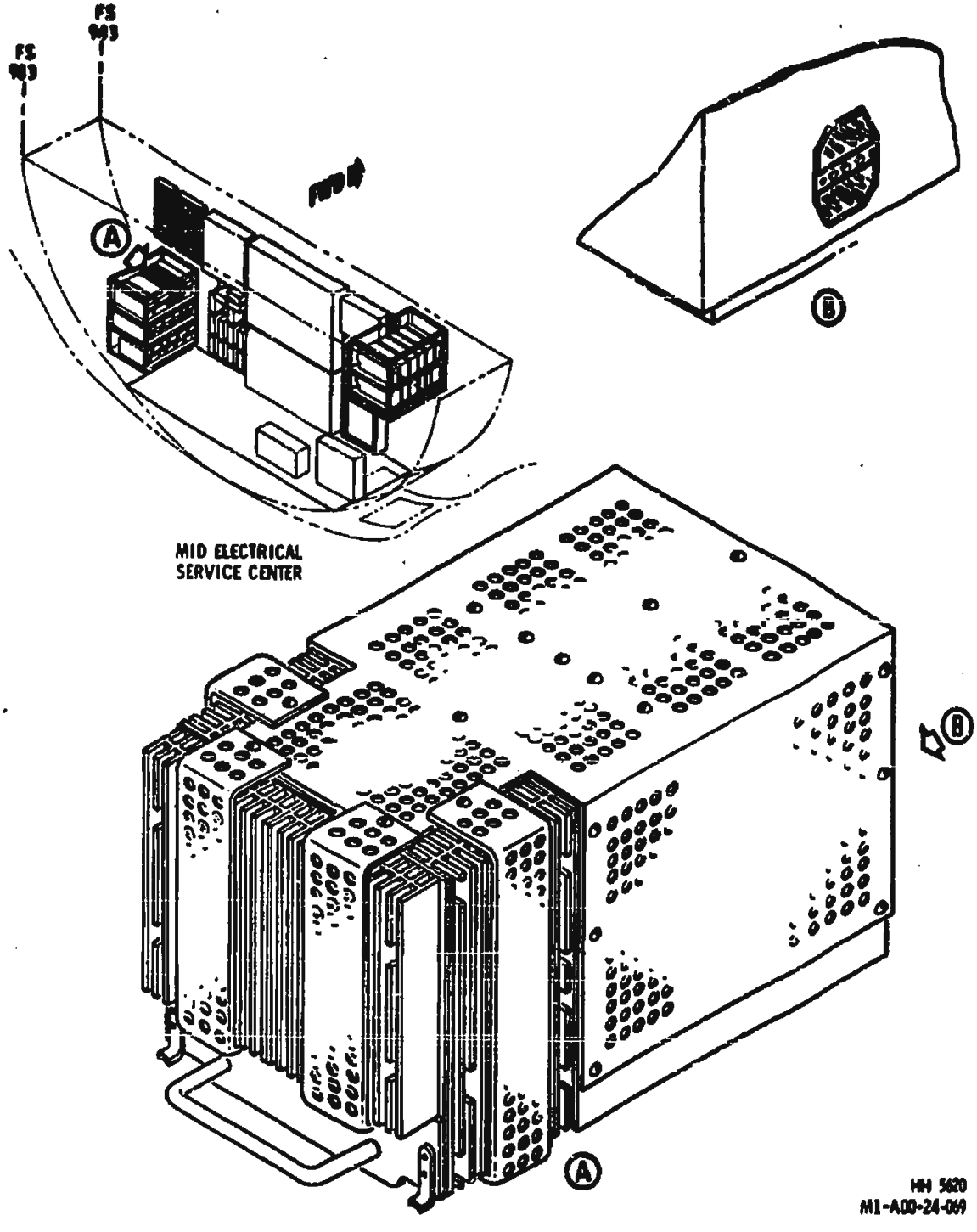
The inverter is energized from the battery bus. Figure 4 is an isometric outline drawing of the inverter. An end-mounted, dual input-output electrical connector automatically mates with a rack-mounted connector. Table 1 lists the principal characteristics of the inverter.

Static Inverter Characteristics
Table 1

ITEM	CHARACTERISTIC
Input	28V dc (nominal)
Steady-state-limits	20.8 to 27.7V dc
Output	Single-phase, two-wire, 115V rms
Steady-state-limits	112.5 to 119.5V rms
Frequency	400 Hz (nominal)
Steady-state-limits	390 to 410 Hz
Normal rating	750 voltamperes at 0.5 lagging-to-unity pf
Overload rating	110,150, and 200% of normal rating for 2 hours, 5 minutes, and 5 seconds, respectively, at rated output voltage
Cooling	Convection and radiation
Weight	18.0 pounds (maximum)

4. Static Inverter Relay

A. Description and Operation



750-VA Static Inverter
Figure 4

When energized, the dc-operated static inverter relay provides battery bus power to energize the static inverter, and opens the circuit to the battery charger relay.

The relay is a 50-ampere, single-pole, single-throw unit, which has in addition to the main 50-ampere contacts, a set of single-pole, double-throw auxiliary contacts.

The relay is energized by placing the STANDBY POWER INSTR & RADIO switch on the eyebrow panel, zone 210, in the ON position. The relay is automatically energized if the ac essential bus fails with the BATTERY switch on the Flight Engineer/Second Officers electrical control panel in the ON position and the STANDBY POWER INSTR & RADIO switch in the ARM position.

5. Nickel-Cadmium Battery

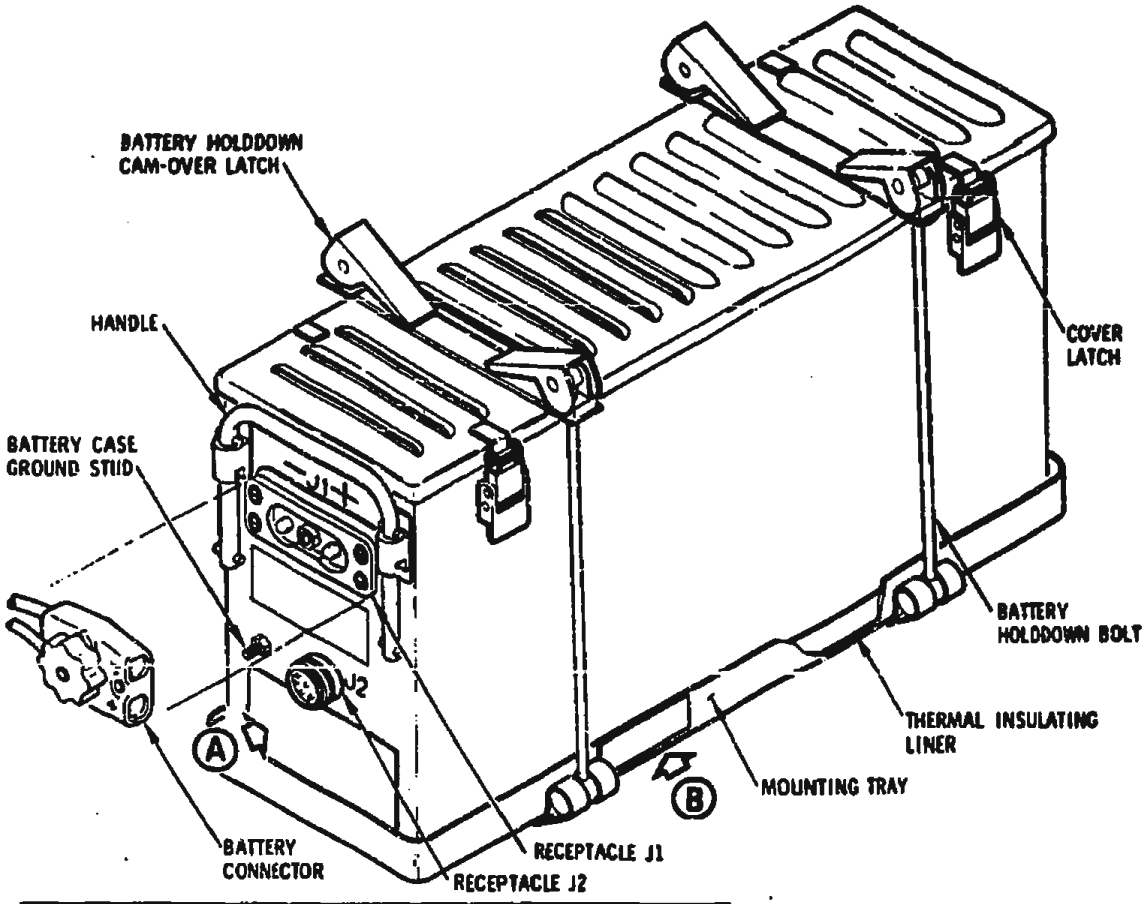
A. Description

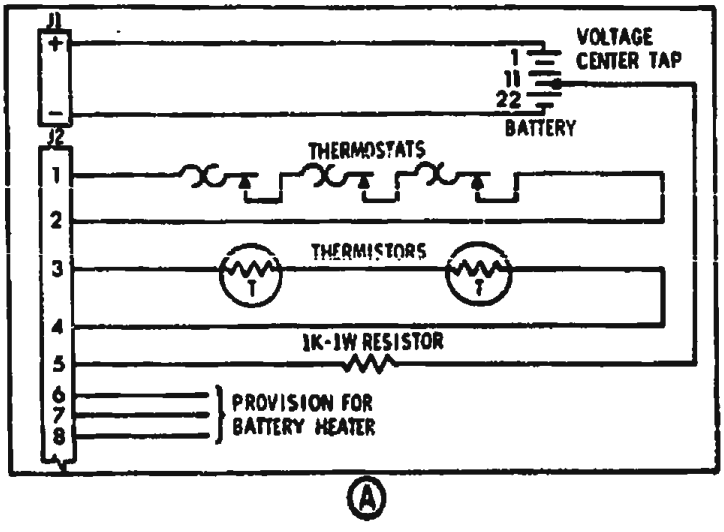
The battery (Ref. Fig. 5) is a nominal 26-volt, 22-cell, nickel-cadmium unit housed in an insulated stainless steel case. The battery has a louvered cover which is held in place with quick-release fasteners.

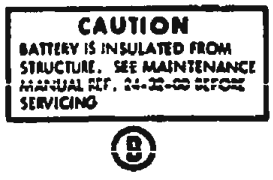
The battery is tray-mounted in the mid electrical service center, zone 137. The battery is held in place by cam-over, holddown battery clamps for quick removal and installation. The metal tray is attached to aircraft structure with bolts and insulating spacers. The battery and tray are insulated from structure except for a bonding jumper which is attached from the battery case to structure ground. The battery is thermally insulated from the tray by an insulating liner. The holddown bolts, when attached to the battery cover, place the battery case and tray at the same potential.

The battery is connected to the dc system by a case-mounted ELCON-type quick disconnect. A case-mounted electrical connector provides a disconnect point for the internally mounted thermistors and thermostats. A resistor connects to the battery center and provides a means of detecting an unbalanced condition within the battery halves.

The electrolyte used in the battery is a 30-percent-by-weight (specific gravity 1.30 at 68 degrees F) solution of potassium hydroxide in distilled water.







MI-0102-24-002

Nickel-Cadmium Battery
Figure 5

WARNING: THE POTASSIUM HYDROXIDE ELECTROLYTE USED IN THE BATTERY IS VERY CORROSIVE. IF SPILLED ON CLOTHING, HANDS, OR MATERIAL IT MUST BE FLOODED IMMEDIATELY WITH WATER OR BORIC ACID SOLUTION. CONSULT A PHYSICIAN IMMEDIATELY IF EYES ARE INVOLVED. RUBBER GLOVES, APRON, AND FACE SHIELDS MUST BE WORN WHEN HANDLING POTASSIUM HYDROXIDE.

If battery water is needed, use pure distilled water only. All containers, droppers, funnels, and other implements that may be used to add water must be clean and free from any trace of acid. Do not use implements that have been used to service lead-acid batteries.

B. Operation

The 26-volt (nominal) battery output is connected to the battery bus at all times. The battery is used to start the APU, to energize the dc standby bus during the APU startup period, and during a loss of primary power. The battery also energizes the single-phase, 750-voltampere standby inverter when needed.

The temperature sensors (thermistors) provide signals to the battery charger to control charger output. Overheat detectors (thermostats) sense an overheat condition and turn on the amber BATTERY CONDITION turn light on the APU control panel, zone 215. An unbalanced battery, as detected by the resistor and circuitry, also turns on the BATTERY CONDITION light.

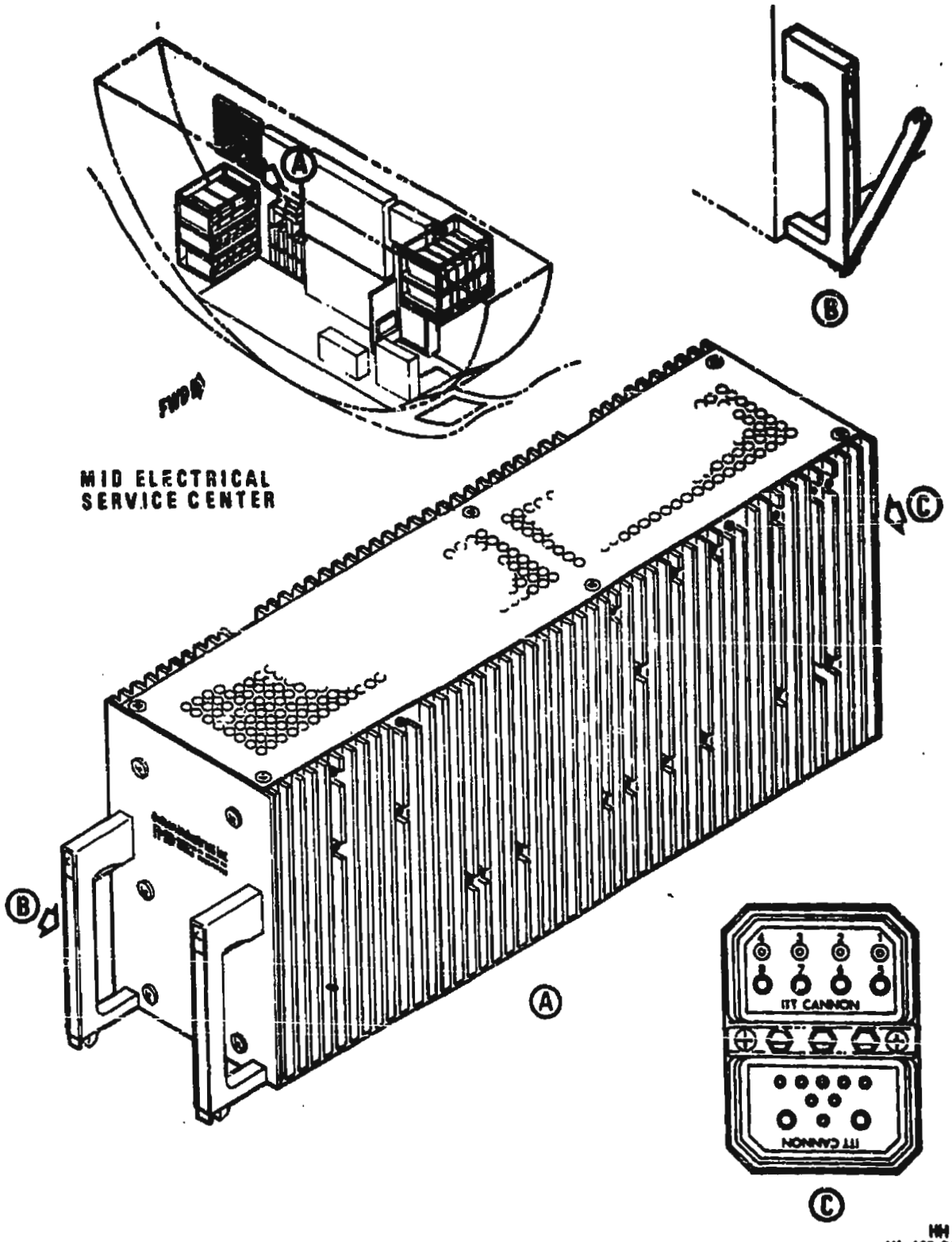
6. Battery Charger

A. Description

The single-package, solid-state battery charger (Ref. Fig. 6) is housed in a case that is rack-mounted in the mid electrical service center, zone 137. The charger is convection- and radiation-cooled. The charger receives three-phase ac power from ac bus 1 and converts it to a dc-charging potential of up to 38 volts. The charger is capable of charging a depleted battery in 90 minutes (maximum).

B. Operation

The battery charger maintains a full charge on the battery through constant charging and pulse demand charging (Reference MM 24-32-00, Adjustment and Test for description of battery charger constant and pulse charging rates). Battery charging is monitored by a thermistor type



HW 5253
M1-A00-24-083

Battery Charger
Figure 6

temperature sensing network within the battery case. Charger output is constant until the battery reaches 85 to 90 percent full capacity. At this point, the charger reverts to a pulsing mode to complete the charge and maintain the battery at full capacity. If battery temperature exceeds a safe operating limit, the charger is deenergized by the battery thermostat action and the BATTERY CONDITION light comes on. The solid-state components are mounted on individual removable modules.

7. Battery Charger Relay

A. Description and Operation

The ac-operated battery charger relay used in the standby power system is a 50-ampere, single-pole, single-throw unit. The relay has, in addition to the main 50-ampere contacts, one set of single-pole, double-throw auxiliary contacts. The relay is located in the mid electrical service center, zone 137. When the relay is energized, the 50-ampere contacts connect the charger output to the standby battery.

The normally energized relay receives power from phase A of ac bus 1, through contacts of the energized battery charger control and standby communications relays, and through contacts of the deenergized dc standby transfer and inverter relays. A second path is through the energized battery charger control relay, the deenergized battery communications, the essential dc master radio, the dc standby transfer and inverter relays. Under certain conditions, the battery charger relay is deenergized to prevent the high-potential battery charger output (up to 38 volts) from reaching the essential communications and the dc standby buses.

8. Battery Charger Control Relay

A. Description and Operation

The dc-operated battery charger control relay is used in the standby power system to control the battery charger relay. The control relay is energized with a signal from the differential pressure sensor (Ref. 21-25-00) which senses differential pressure across the exhaust fan in the mid electrical service center ventilation duct, zone 137.

The battery charger control relay is a polarized, 10-ampere, double-pole, double-throw, sealed and welded unit that has eight gold-over-silver plated plug-in-type contacts. The relay, which is located in the mid electrical service

center, plugs into a prewired socket. The relay has a holddown flange on each end.

The relay energizes and enables part of the circuit to the battery charger relay upon receiving a 28V dc signal from the differential pressure sensor that exhaust air flow is sufficient for battery cooling and ventilation during charging.

9. APU Shunt Relay

A. Description and Operation

The APU shunt relay is a double-pole, double-throw, 2-ampere, low-level switching unit that has eight gold-plated plug-in-type contacts. The hermetically sealed relay is used in the dc ammeter switching circuit to allow a multiplying factor to be introduced for all current measurements during APU start. The relay is located in the mid electrical service center, zone 137, where it plugs into a prewired socket.

When starting the APU, the relay is energized and connects a current-limiting resistor in series with the dc meter. The resistor changes the meter scale factor so that the meter reading must be multiplied by five to reflect correct APU starting current.

10. Inverter Control Relay

A. Description and Operation

The inverter control relay is a polarized, 10-ampere, two-pole, double-throw sealed and welded unit that has eight gold-over-silver plated plug-in-type contacts. The relay plugs into a prewired socket. The relay has a holddown flange on each end.

The relay is energized along with Phase A of the ac essential bus. When energized, the relay opens one section of the dual circuit which controls the static inverter relay. When the relay is deenergized, the partial circuit is restored. With the BATTERY switch in the ON position and the STANDBY POWER INSTR & RADIO switch in the ARM position, the inverter relay and the inverter will be energized immediately if the ac essential bus becomes deenergized.

11. DC Essential Bus Sensing Relay

A. Description and Operation

The dc essential bus sensing relay is used to detect a failed dc essential bus and to energize the dc standby transfer relay (under certain conditions). The relay also provides dc essential bus fail indication signals to the pilots and to the Flight Engineer/Second Officer.

The relay is a polarized, 10-ampere, double-pole, double-throw, sealed and welded unit that has eight gold-over-silver plated plug-in-type contacts. The relay plugs into a prewired socket. The relay has a holddown flange on each end.

If the dc essential bus fails, the relay deenergizes. If the BATTERY switch on the FE/SO control panel, zone 215, is in the ON position, the relay energizes the dc standby transfer relay. The deenergized relay also lights the DC ESSENTIAL BUS FAIL (red) warning light on the electrical control panel. The ESS/STBY POWER (red) legend on the pilots caution and warning panel, zone 210, also comes on.

12. AC Standby Bus Sensing Relay

A. Description and Operation

The ac-operated ac standby bus sensing relay is used in the standby power system to detect a failure of the ac standby bus. The relay also provides a signal for ac standby power system and bus status to the FE/SO and to the pilots.

The relay is a polarized, 10-ampere, four-pole, double-throw, sealed and welded unit that has 14 gold-over-silver plated plug-in-type contacts. The relay plugs into a prewired socket. The relay has holddown flanges on two sides.

The relay, when energized (normal) enables part of the circuit to the STBY PWR ON light on FE/SO electrical control panel, zone 215. The energized relay also enables part of the circuit to the flowbar light portion of the STBY PWR indicator on the electrical control panel.

With a failure of the ac standby bus, the relay deenergizes. This action disables one section of the STBY PWR ON light circuit, disables the STBY PWR flowbar light and turns on the ESS/STBY POWER legend on the pilots caution and warning panel.

13. DC Standby Bus Sensing Relay

A. Description

The dc standby bus sensing relay is used in the standby power system to detect and to alert the flight crew to a failed dc standby bus. The 10-ampere, four-pole, double-throw, sealed and welded unit plugs into a prewired socket in the FE/SO console, zone 215.

The relay is normally energized along with the dc standby bus. The relay controls part of the circuits to the STBY PWR ON light and the STBY PWR flowbar light on the FE/SO electrical control panel, zone 215. The relay directly controls the DC STBY BUS FAIL light on the electrical control panel.

B. Operation

If the dc standby bus fails, the relay is deenergized and connects dc essential bus power to the DC STBY BUS FAIL light on the electrical control panel and to the ESS/STBY POWER legend on the pilots caution and warning panel.

14. AC Standby Transfer Relay

A. Description and Operation

The ac-operated ac standby transfer relay performs two functions. Its primary function is to transfer the ac standby bus from its normal power source to its alternate power source whenever the inverter is energized. When energized, the relay enables one section of the STBY PWR ON light and the STBY PWR flowbar light on the FE/SO electrical control panel.

The relay is a polarized, 10-ampere, double-pole, double-throw, sealed and welded unit that plugs into a prewired socket in the flight station overhead panel, zone 210. The relay has a holddown flange on each end.

The normally energized relay connects the single-phase ac standby bus to its normal source (phase A of the ac essential bus). The relay is energized when a bus failure occurs together with the inverter and transfers the ac standby bus to its alternate source (the inverter output). When the relay is energized due to a bus failure, the ELECTRICAL SYSTEM legend on the pilots caution and warning panel comes on.

15. DC Standby Transfer Relay

A. Description and Operation

The dc standby relay is a 50-ampere, single-pole, single-throw relay located behind the Pilots Overhead Circuit Breaker Panel (CB1), zone 210. This relay is used to transfer the dc standby bus (under certain conditions) from its normal to its alternate power source. The relay also operates with other relays to control the battery charger relay. A third function is to control one section of the STBY PWR ON light on the FE/SO electrical control panel, and turn on, when a bus failure occurs, the ELECTRICAL SYSTEM legend on the pilots caution and warning panel.

The dc standby transfer relay is (manually) energized with battery power whenever the STANDBY POWER INSTR & RADIO switch is in the ON position. The relay is automatically energized (with battery power) with a loss of the dc essential bus, provided the BATTERY switch on the electrical control panel is in the ON position.

When energized, the 50-ampere contacts transfer the dc standby bus from the dc essential to the battery bus. At the same time, a set of auxiliary contacts open the circuit to the battery charger relay actuator coil. A second set of auxiliary contacts enable one section of the STBY PWR ON light circuit. The ELECTRICAL SYSTEM legend on the pilots caution and warning panel, comes on whenever the STBY PWR ON light is on.

16. Engine Start Bus Relay

A. Description and Operation

The engine start bus relay is used in the standby power system to connect dc essential (or battery) power to the engine start bus. This arrangement allows the engines to be started in flight under emergency conditions. The 50-ampere single-pole, single-throw relay is located in the FE/SO console area.

The normally deenergized relay connects the engine start bus to the dc essential bus. When energized, the relay connects the engine start bus to the battery bus. The relay is manually energized by placing the STANDBY POWER INSTR & RADIO switch on the eyebrow panel, zone 210, in the ON position. The relay is energized automatically with a failure of the dc essential bus, provided the BATTERY switch on the FE/SO control panel is in the ON position.

17. Engine Start Bus

A. Description and Operation

The engine start bus energizes 28V dc circuits which are necessary for starting the engines. The bus is normally energized from the dc essential bus through closed contacts of the normally deenergized engine start bus relay.

The bus automatically switches to the battery whenever the standby power system is on, or in the event of a failure of the dc essential bus while the BATTERY switch on FE/SO electrical control panel is in the ON position. Circuit breakers energized by the engine start bus are located on the pilots overhead circuit breaker panel CB1, zone 210, and on the FE/SO aft circuit breaker panel CB3.

18. Engine Start Bus Sensing Relay

A. Description and Operation

The engine start bus sensing relay (Ref. Fig. 2) is used in the standby power system to verify that the engine start bus transfer circuit is operational. The 10-ampere, double-pole, double-throw, dc-operated relay is located on the flight station overhead relay panel, zone 210.

The relay is actuated only when the engine start bus is energized from the battery bus in the standby power mode. With the STANDBY POWER INSTR & RADIO switch on the pilots eyebrow panel, in the ON position, the STBY PWR on flowbar on the (FE/SO electrical) control panel comes on to verify transfer and energizing of the engine start bus.

19. Battery Charger Mode Select Switch

A. Description and Operation

The Battery Charger Mode Select Switch is a two-pole, double throw switch, rated at 28V dc, 4 amperes, 115V as 400 cycles, 3 amp 5 millivolt, AC-DC 23 microamp minimum current

With the Battery Charger Select Switch in the NORM position the battery charger maintains a full charge on the battery. In the STBY position the battery charger interlocks are bypassed and the battery bus and standby busses are powered from the battery charger.

20. Battery Bus Extension Current Level Time Delay Relay

A. Description and Operation

The Battery Bus Extension Current Level Time Delay Relay is a 2 pole, double throw relay with a 5 second time delay and a 50 millisecond maximum recycle time. It is located at the FE/SO station, zone 210.

If the battery bus dc current level detector provides an output indicating battery discharge for five or more seconds, the time delay relay contacts transfer and the standby power ON light illuminates on the FE/SO electrical panel. The time delay prevents illumination of the standby power ON light during momentary battery power demands.

21. Battery Bus Extension DC Current Level Detector

CAUTION: DC CURRENT LEVEL DETECTOR IS SENSITIVE TO DIRECTION OF CURRENT FLOW.

A. Description and Operation

The Battery Bus Extension DC Current Level Detector provides a means of monitoring current flow to the battery bus extension. The detector contains a single pole double throw electro-mechanical relay with an excitation voltage of 25 volts. The Battery Bus Extension DC Current Level Detector is located at the FE/SO station, zone 208.

If the battery bus extension current level exceeds 1.15 amps the internal relay contacts transfer and provide power to energize the Battery Extension Time Delay Relay. The detector automatically resets when the current flow drops below 0.85 amps.

STANDBY POWER SYSTEM - FAULT ISOLATION

1. General

The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 33 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

2. Fault Isolation Identification

Table 101 is a list of the standby power system fault isolation diagrams and schematics. Figure 101 and 102 provide component location for troubleshooting.

Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagram
103	Battery and Charger Control Fault Isolation
104	Standby Power Unarm Control Fault Isolation
105	STBY PWR ON Control Fault Isolation
106	STBY PWR Flowbar Control Fault Isolation
107	Battery Charger Powered Standby Bus Fault Isolation

(Cont)
Table 101

FIGURE	TITLE
SCHEM 1	Standby Power System Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
BATTERY	1	MESC/137AB	24-32-03
BOX - INDICATOR LIGHTS CONTROL	1	FESC/112AB	33-17-04
CHARGER - BATTERY	1	MESC/137AB	24-32-04
CIRCUIT BREAKERS:			
AC STBY BUS PWR 2432-CB16	1	FLT STA/CB3 F12	#
ANNUNCIATOR RESET 3317-CB12	1	FLT STA/CB1 L9	#
BATTERY CHARGER RCCB 2432-CB17	1	MESC/137AB	#
DC AUTO TRANSFER 2432-CB14	1	FLT STA/CB3 G13	#
DC ESS BUS DC STBY PWR 2432-CB12	1	FLT STA/CB3 F1	#
DC POWER BAT CHG	1	FLT STA/CB3 A15	#
ELEC BUS CONT AC STBY BUS SENSE 2432-CB15	1	FLT STA/CB1 K10	#
ELEC BUS CONT DC STBY INDICATOR 2432-CB1	1	FLT STA/CB1 K13	#
ELEC BUS CONT ENGINE START BUS SENSE 2432-CB24	1	FLT STA/CB1 K12	#
ELEC METER SWITCH 2430-CB2	1	FLT STA/CB3 G16	#
ENGINE START PWR 2432-CB19	1	FLT STA/CB1 B15	#
ENGINE START PWR 2432-CB20	1	FLT STA/CB3 F10	#
HYD-PUMP & FIREWALL SHUTOFF VALVE CONT - SYS D 2911-CB4	1	FLT STA/CB1 L10	#
PILOTS IND LT TEST 3317-CB2	1	FLT STA/CB2 H9	#
STANDBY DC CONT 2432-CB11	1	FLT STA/CB1 B12	#
STANDBY DC POWER 2432-CB13	1	FLT STA/CB1 B13	#
STBY INVERTER VOLTAGE 2432-CB21	1	FLT STA/CB1 K18	#
CURRENT LIMITER -35A	1	MESC, BATTERY BOX	#
DETECTOR - BATTERY BUS EXTENSION CURRENT LEVEL	1	FLT STA, ABOVE FE/SO OVHD CB PANEL	24-32-28
INVERTER - STATIC	1	MESC, LH RACK/137AB	24-32-01
LIGHT - AC ESSENTIAL BUS FAIL	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20-33-04
LIGHT - AC STANDBY BUS FAIL	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20-33-04
LIGHT - BATTERY CONDITION	1	FLT STA, FE/SO APU CONTROL PANEL	20-33-04
LIGHT - DC ESSENTIAL BUS FAIL	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20-33-04

SEE MM EQUIPMENT LIST

M1-0001-24-884

R Component Location Index
R Figure 101 (Sheet 1)

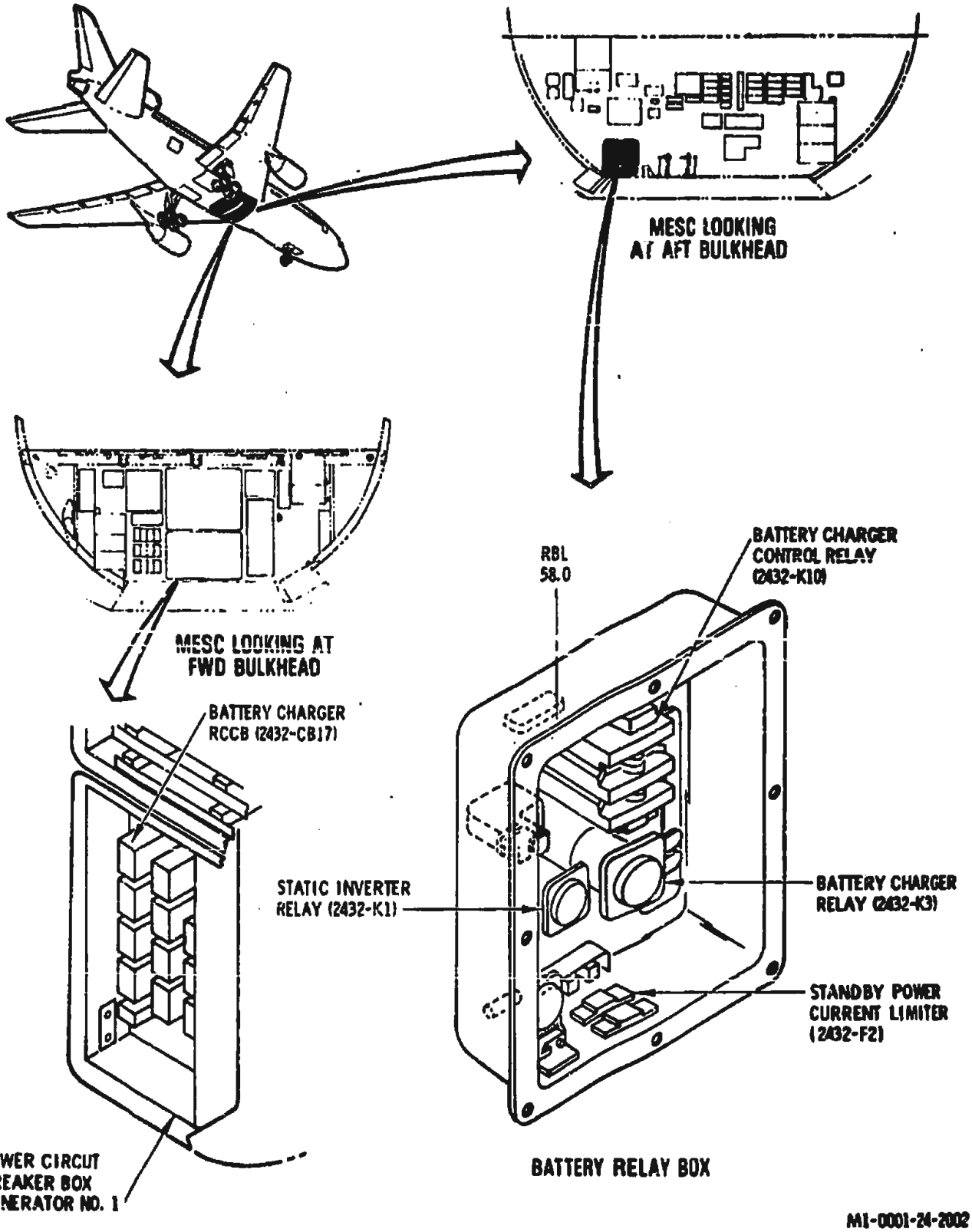
EFFECTIVITY: ALL

001B

COMPONENT	QTY	AREA/ACCESS	REFERENCE
LIGHT – DC STANDBY BUS FAIL	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20–33–04
LIGHT – STANDBY POWER ON	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20–33–03
LIGHT – STANDBY POWER ON FLOWBAR	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20–33–03
LIGHT – STANDBY POWER SYSTEM UNARM	1	FLT STA, PILOTS EYEBROW PANEL	20–33–04
LIMITER – 50 AMPERE CURRENT	1	MESC, BATTERY RELAY BOX	20–24–01
METER AC VOLTS	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20–24–01
RELAYS:			
AC STANDBY BUS SENSING 2432-K2	1	FLT STA, ABOVE FE/SO OVHD CB PANEL	20–24–01
AC STANDBY BUS TRANSFER 2432-K8	1	FLT STA, ABOVE FE/SO OVHD CB PABEL	20–24–01
BATTERY BUS EXTENSION CURRENT LEVEL TIME DELAY 2432-K14	1	FLT STA, ABOVE FE/SO OVHD CB PANEL	24–32–27
BATTERY CHARGER CONTROL 2432-K10	1	MESC, BATTERY RELAY BOX	20–24–01
BATTERY CHARGER 2432-K3	1	MESC, BATTERY RELAY BOX	24–32–05
DC ESSENTIAL BUS SENSING 2432-K4	1	FLT STA, FE/SO RELAY PANEL	20–24–01
DC STANDBY BUS SENSING 2432-K7	1	FLT STA, FE/SO RELAY PANEL	20–24–01
DC STANDBY BUS TRANSFER 2432-K11	1	FLT STA, FE/SO RELAY PANEL	20–24–01
ENGINE START BUS 2432-K12	1	FLT STA, BEHIND TRIM PANEL ON TOP OF FE/SO INSTRUMENT PANEL	24–32–24
STATIC INVERTER CONTROL 2432-K9	1	FLT STA, FE/SO RELAY PANEL	20–24–01
STATIC INVERTER 2432-K1	1	MESC, BATTERY RELAY BOX	24–32–02
SWITCH – BATTERY	1	FLT STA, FE/SO ELECTRICAL CONTROL PANEL	20–24–01
SWITCH – BATTERY CHARGER MODE SELECT	1	FLT STA/CB3 K2	20–24–01
SWITCH – STANDBY POWER INSTRUMENT AND RADIO	1	FLT STA, PILOTS EYEBROW PANEL	20–24–01

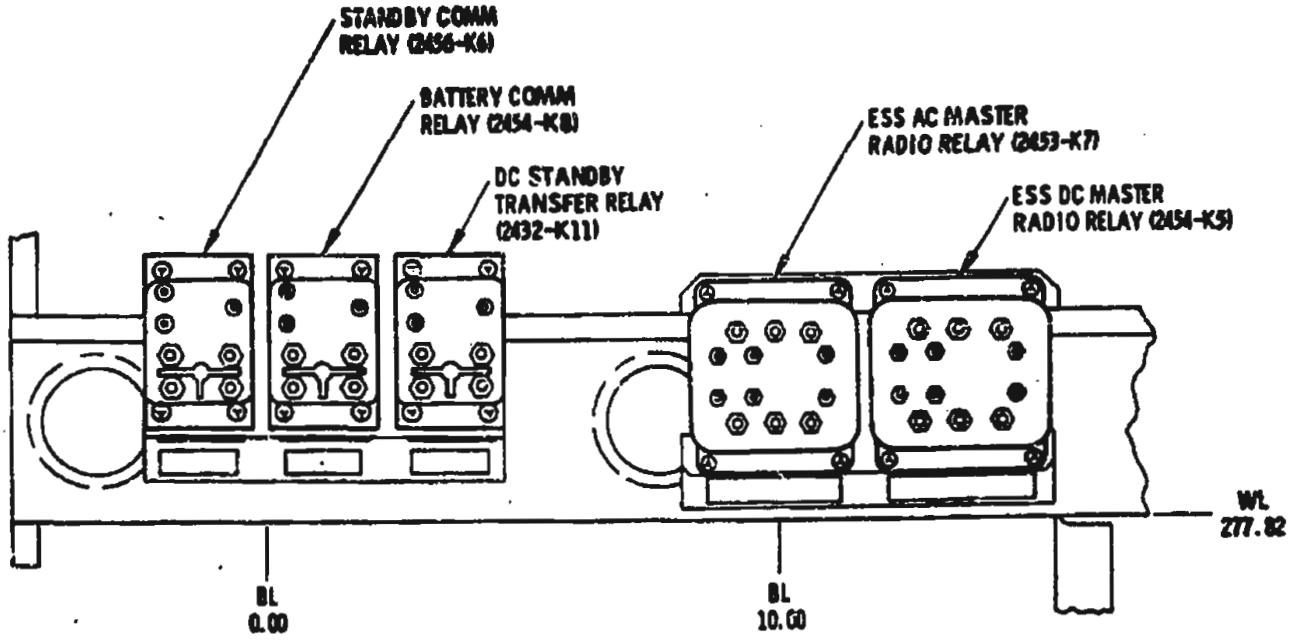
M1–0000–24–885

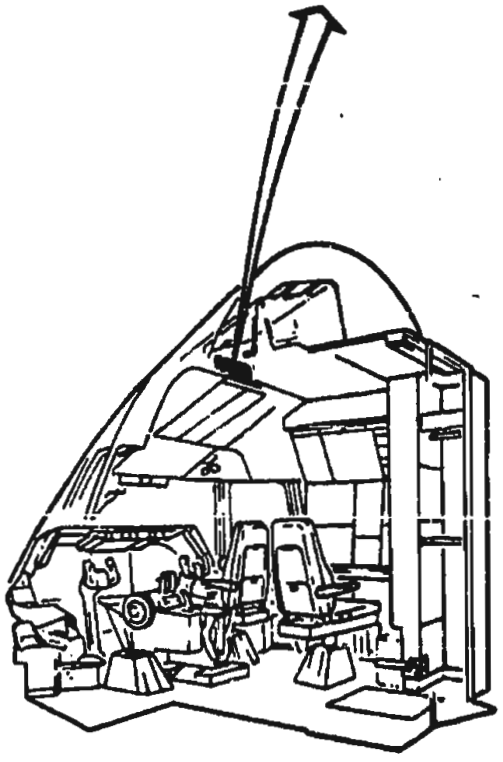
Component Location Index
Figure 101 (Sheet 2)

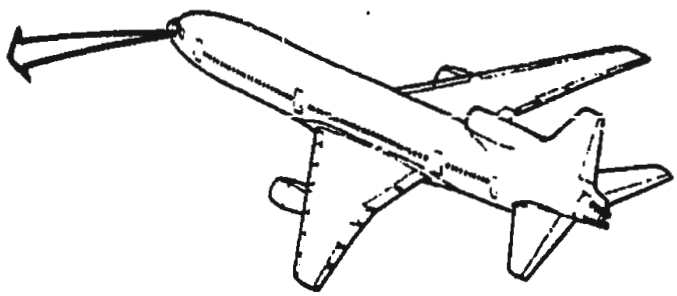

MESC LOOKING AT AFT BULKHEAD
MESC LOOKING AT FWD BULKHEAD
BATTERY CHARGER RCCB (2432-CB17)
RBL 58.0
BATTERY CHARGER CONTROL RELAY (2432-K10)
STATIC INVERTER RELAY (2432-K1)
BATTERY CHARGER RELAY (2432-K3)
STANDBY POWER CURRENT LIMITER (2432-F2)
LOWER CIRCUT BREAKER BOX GENERATOR NO. 1
BATTERY RELAY BOX
M1-0001-24-2002

R
R

Component Locator Diagram
Figure 102 (Sheet 1)







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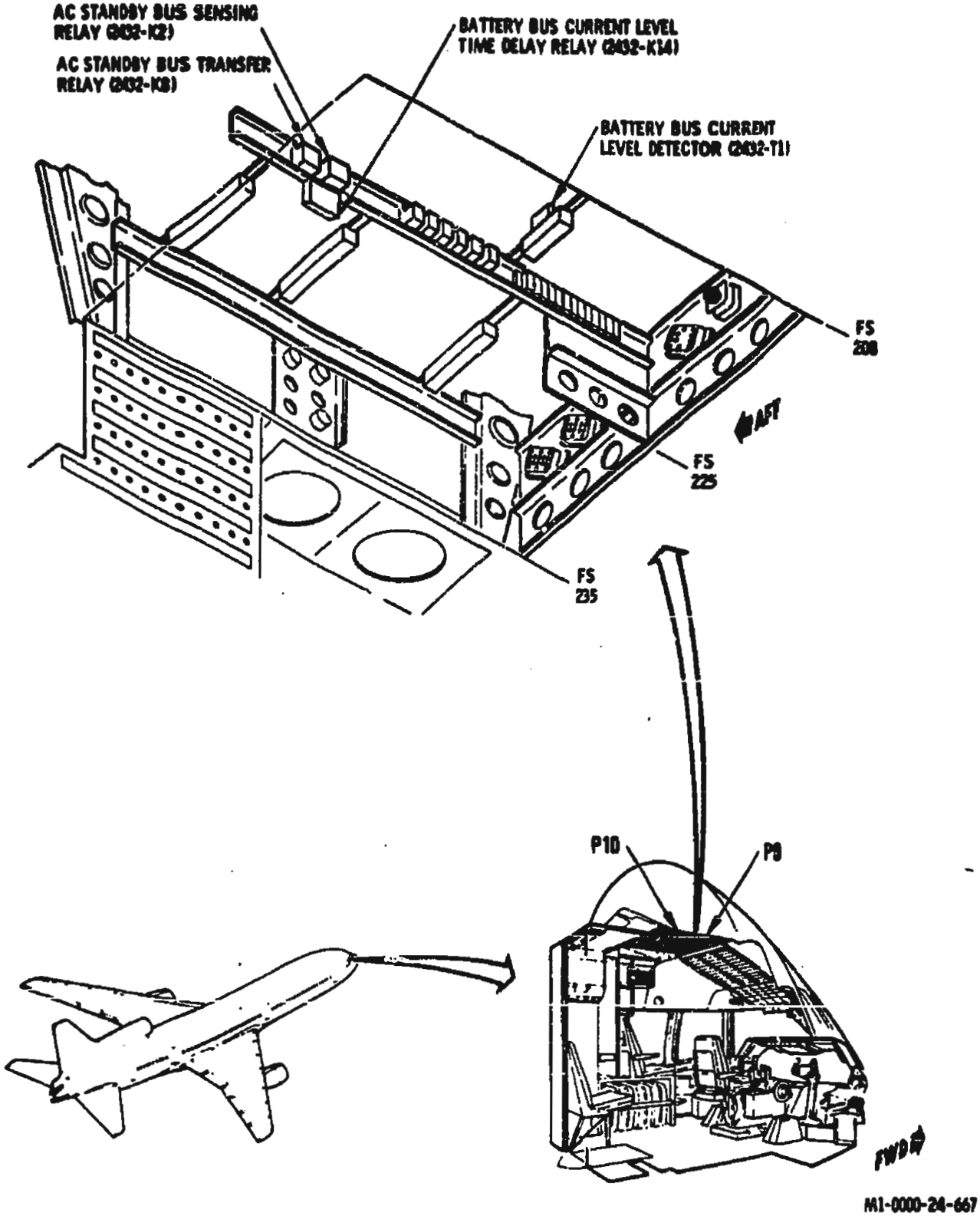
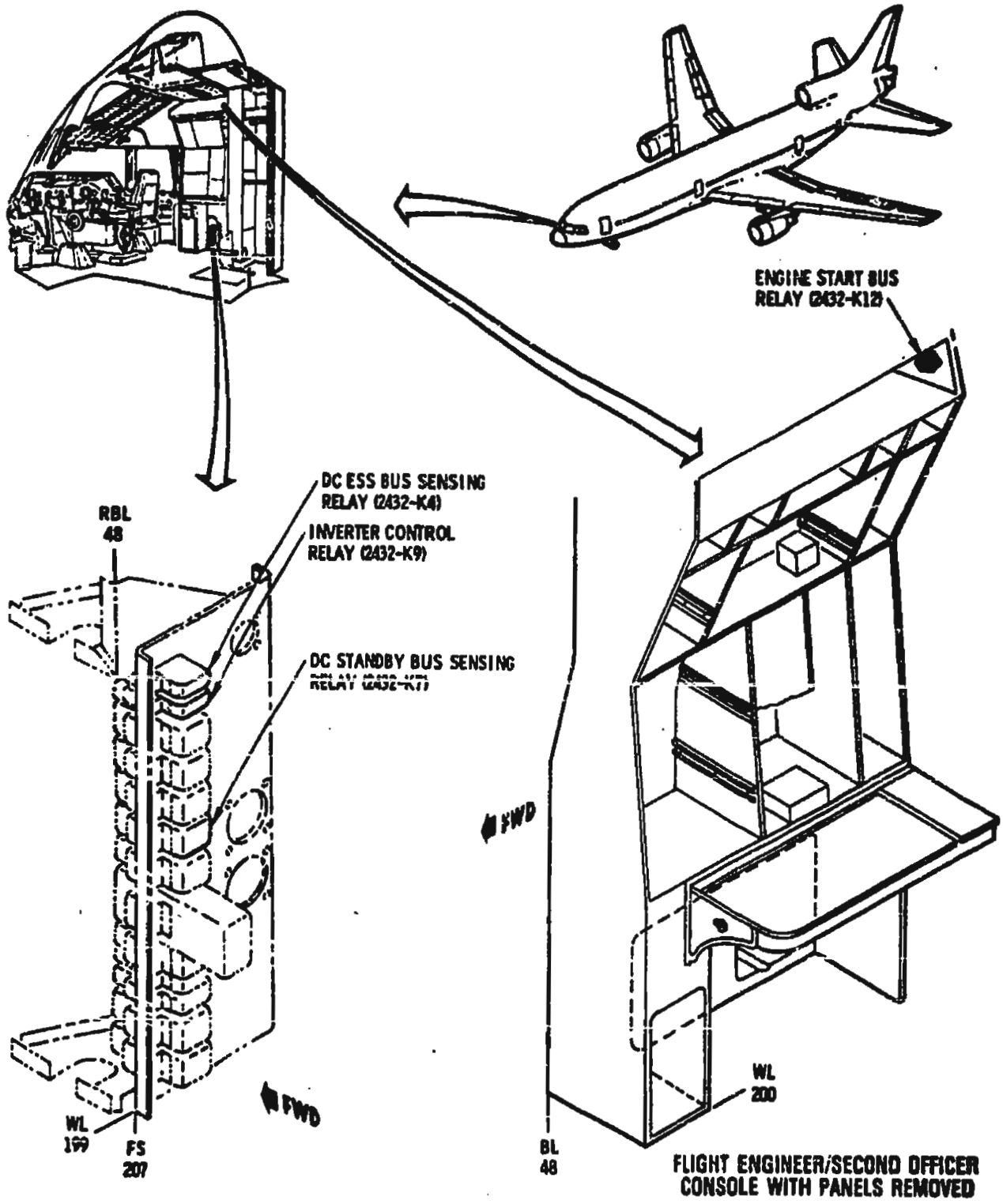
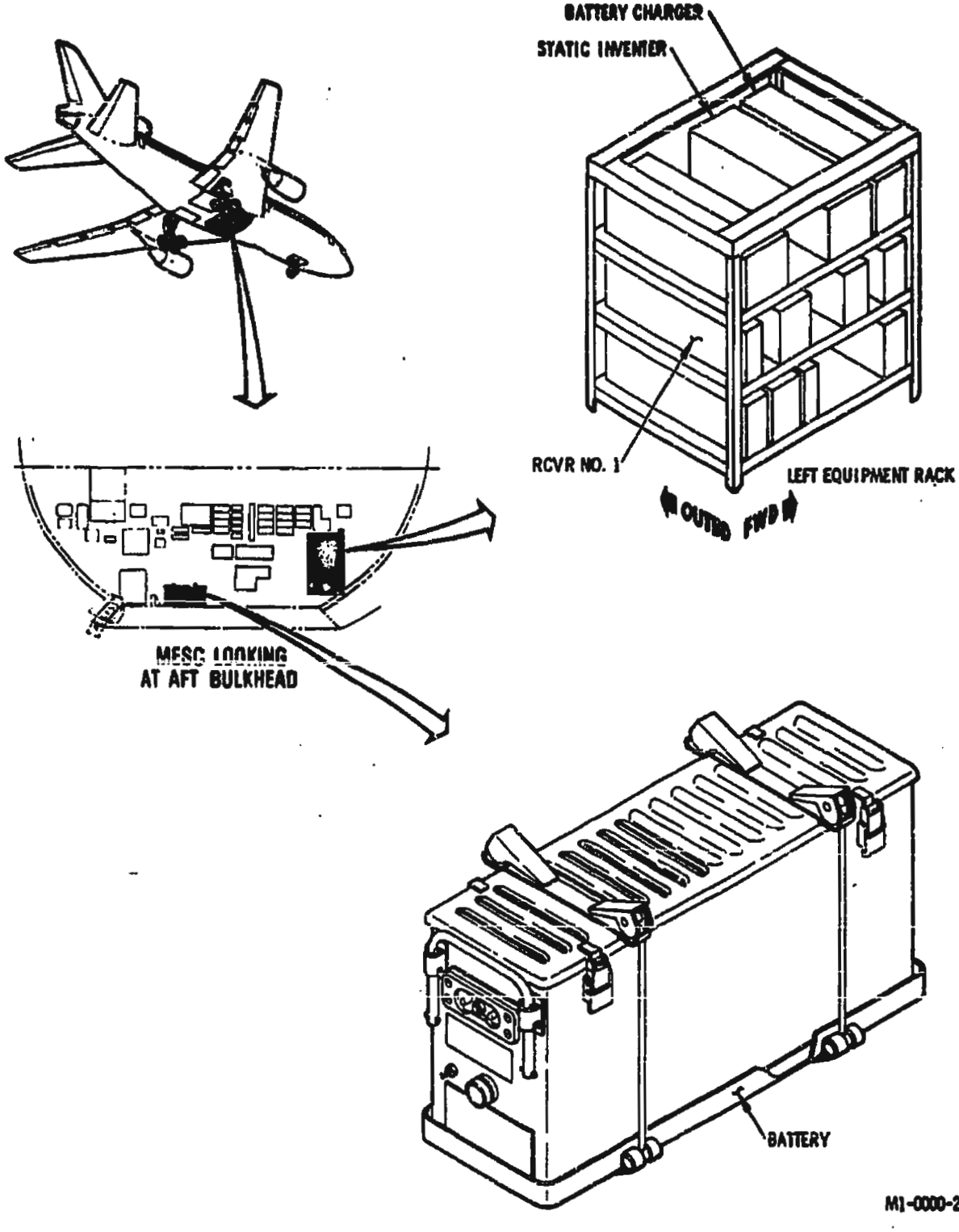
Component Locator Diagram
Figure 102 (Sheet 2)



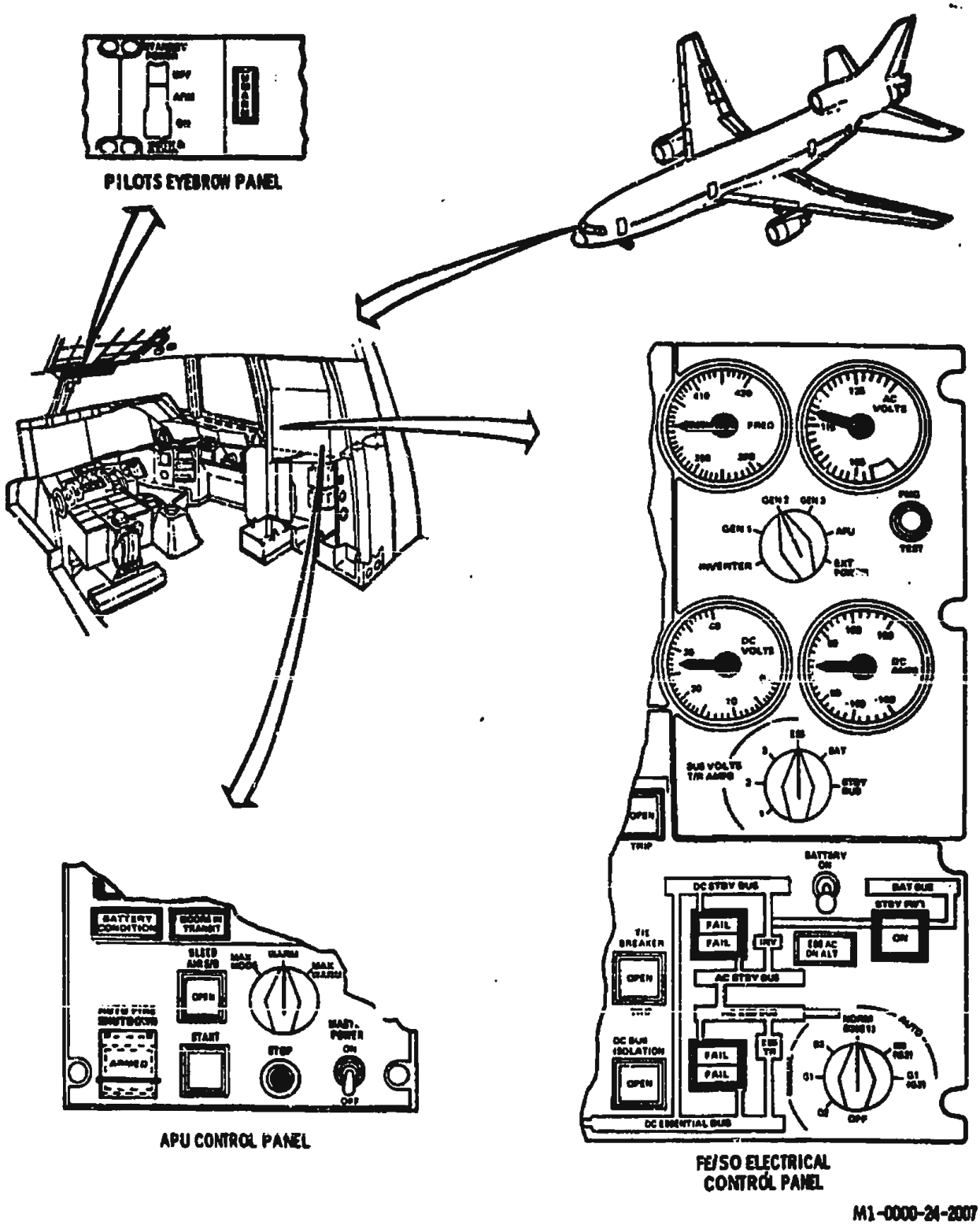
Component Locator Diagram
Figure 102 (Sheet 3)



Component Locator Diagram
Figure 102 (Sheet 4)



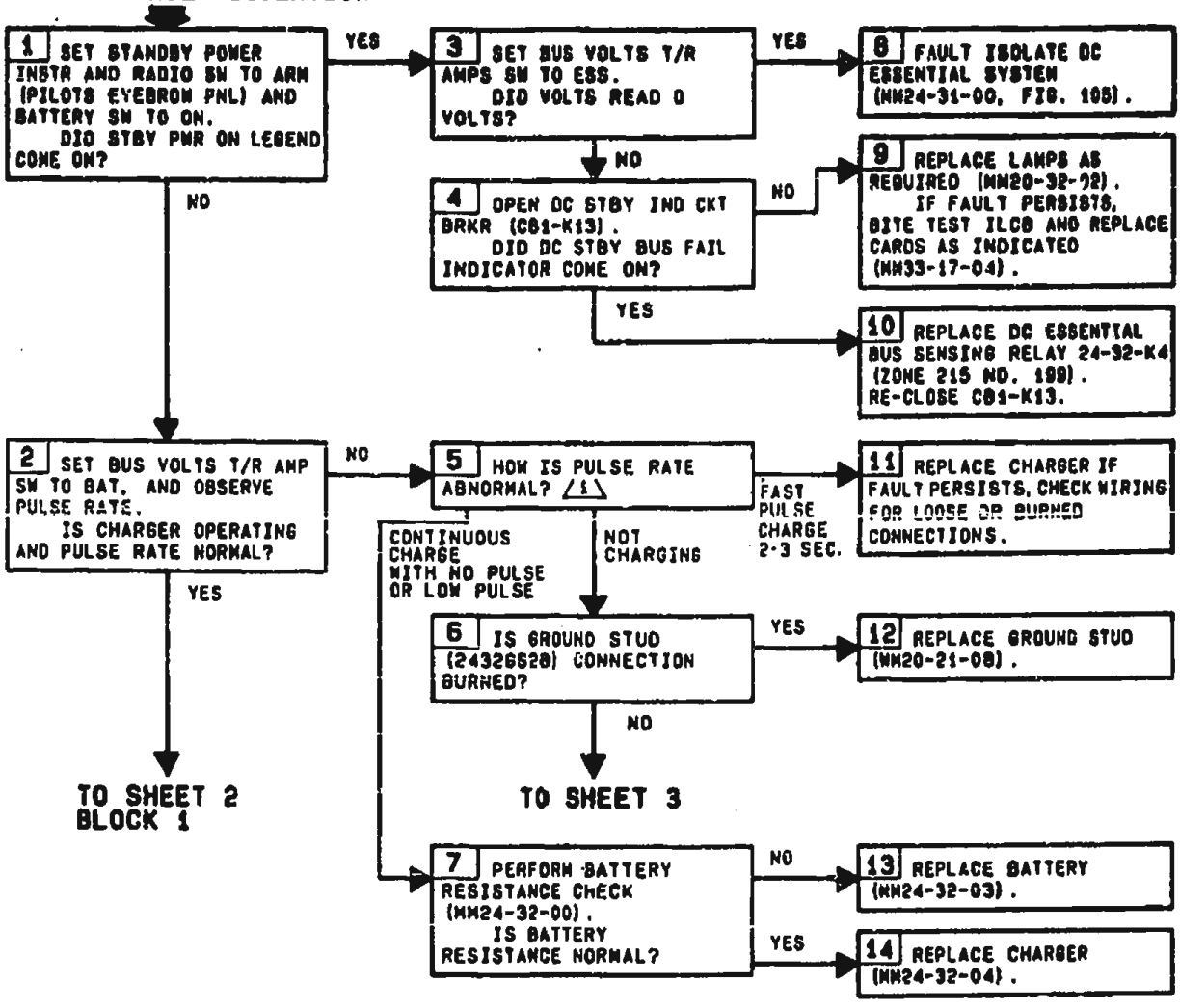
Component Locator Diagram
Figure 102 (Sheet 5)



Component Locator Diagram
Figure 102 (Sheet 6)

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
MEBC EXHAUST FAN OPERATING (MM21-25-00)
DC ESSENTIAL SYSTEM OPERATING (MM24-31-00)
BATTERY CHARGE MODE SELECT SWITCH IN NORM POSITION (CB3-K2)
CB'S IN: CB1-B12, B13, B15, K10, K12, K13, K18, 1L8
CB2-H8
CB3-A15, F1, F10, F12, G13, G16

BATTERY AND CHARGER CONTROL FAULT ISOLATION


1 SET STANDBY POWER INSTR AND RADIO SW TO ARM (PILOTS EYEBROW PNL) AND BATTERY SW TO ON. DID STBY PWR ON LEGEND COME ON?
YES
NO
3 SET BUS VOLTS T/R AMPS SW TO ESS. DID VOLTS READ 0 VOLTS?
YES
NO
8 FAULT ISOLATE DC ESSENTIAL SYSTEM (MM24-31-00, FIG. 105).
4 OPEN DC STBY IND CKT BRKR (CB1-K13). DID DC STBY BUS FAIL INDICATOR COME ON?
NO
YES
9 REPLACE LAMPS AS REQUIRED (MM20-32-22). IF FAULT PERSISTS, BITE TEST ILCO AND REPLACE CARDS AS INDICATED (MM33-17-04).
10 REPLACE DC ESSENTIAL BUS SENSING RELAY 24-32-K4 (ZONE 215 NO. 199). RE-CLOSE CB1-K13.
2 SET BUS VOLTS T/R AMP SW TO BAT, AND OBSERVE PULSE RATE. IS CHARGER OPERATING AND PULSE RATE NORMAL?
NO
YES
5 HOW IS PULSE RATE ABNORMAL? 1
FAST PULSE CHARGE 2-3 SEC.
11 REPLACE CHARGER IF FAULT PERSISTS, CHECK WIRING FOR LOOSE OR BURNED CONNECTIONS.
CONTINUOUS CHARGE WITH NO PULSE OR LOW PULSE
NOT CHARGING
6 IS GROUND STUD (24326520) CONNECTION BURNED?
YES
12 REPLACE GROUND STUD (MM20-21-08).
NO
TO SHEET 2 BLOCK 1
TO SHEET 3
7 PERFORM BATTERY RESISTANCE CHECK (MM24-32-00). IS BATTERY RESISTANCE NORMAL?
NO
13 REPLACE BATTERY (MM24-32-03).
YES
14 REPLACE CHARGER (MM24-32-04).

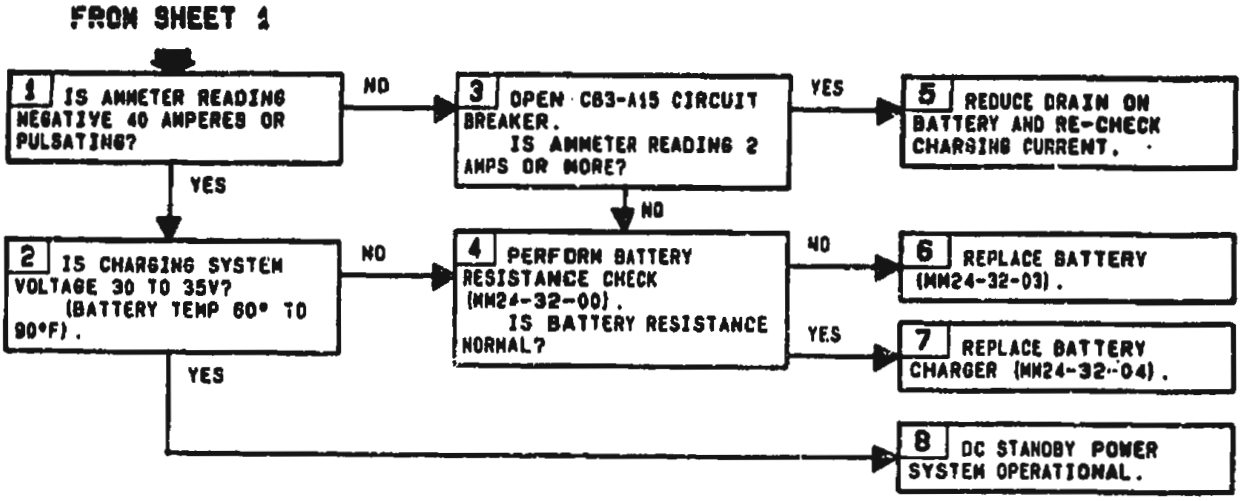
NOTE

1 MANY FACTORS CAN CAUSE A HIGH PULSE RATE: BATTERY CONDITION, BATTERY TEMPERATURE, PREVIOUS LOAD USED. THEREFORE, PULSE RATE SHOULD NOT BE USED TO MONITOR SYSTEM PERFORMANCE.
PULSE RATE WILL USUALLY FALL BETWEEN 5 AND 30 SECONDS.

M1-0005-24-1117

R Battery and Charger Control Fault Isolation
R Figure 103 (Sheet 1)

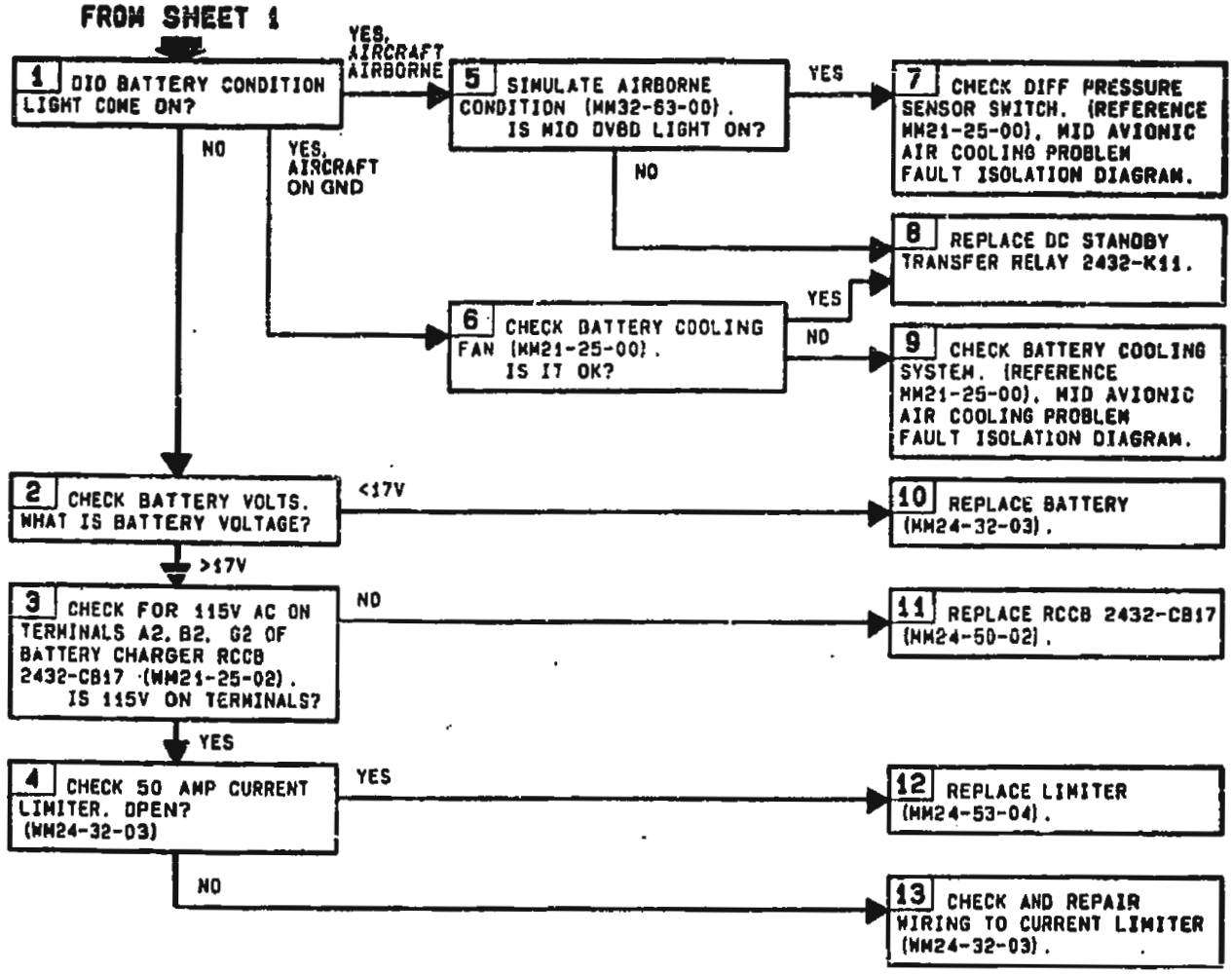
PREREQUISITES
SEE SHEET 1


FROM SHEET 1
1 IS AMMETER READING NEGATIVE 40 AMPERES OR PULSATING?
NO
3 OPEN CB3-A15 CIRCUIT BREAKER. IS AMMETER READING 2 AMPS OR MORE?
YES
5 REDUCE DRAIN ON BATTERY AND RE-CHECK CHARGING CURRENT.
YES
NO
2 IS CHARGING SYSTEM VOLTAGE 30 TO 35V? (BATTERY TEMP 60° TO 90°F).
NO
4 PERFORM BATTERY RESISTANCE CHECK (MM24-32-00). IS BATTERY RESISTANCE NORMAL?
NO
6 REPLACE BATTERY (MM24-32-03).
YES
7 REPLACE BATTERY CHARGER (MM24-32-04).
YES
8 DC STANDBY POWER SYSTEM OPERATIONAL.

M1-0001-24-1118

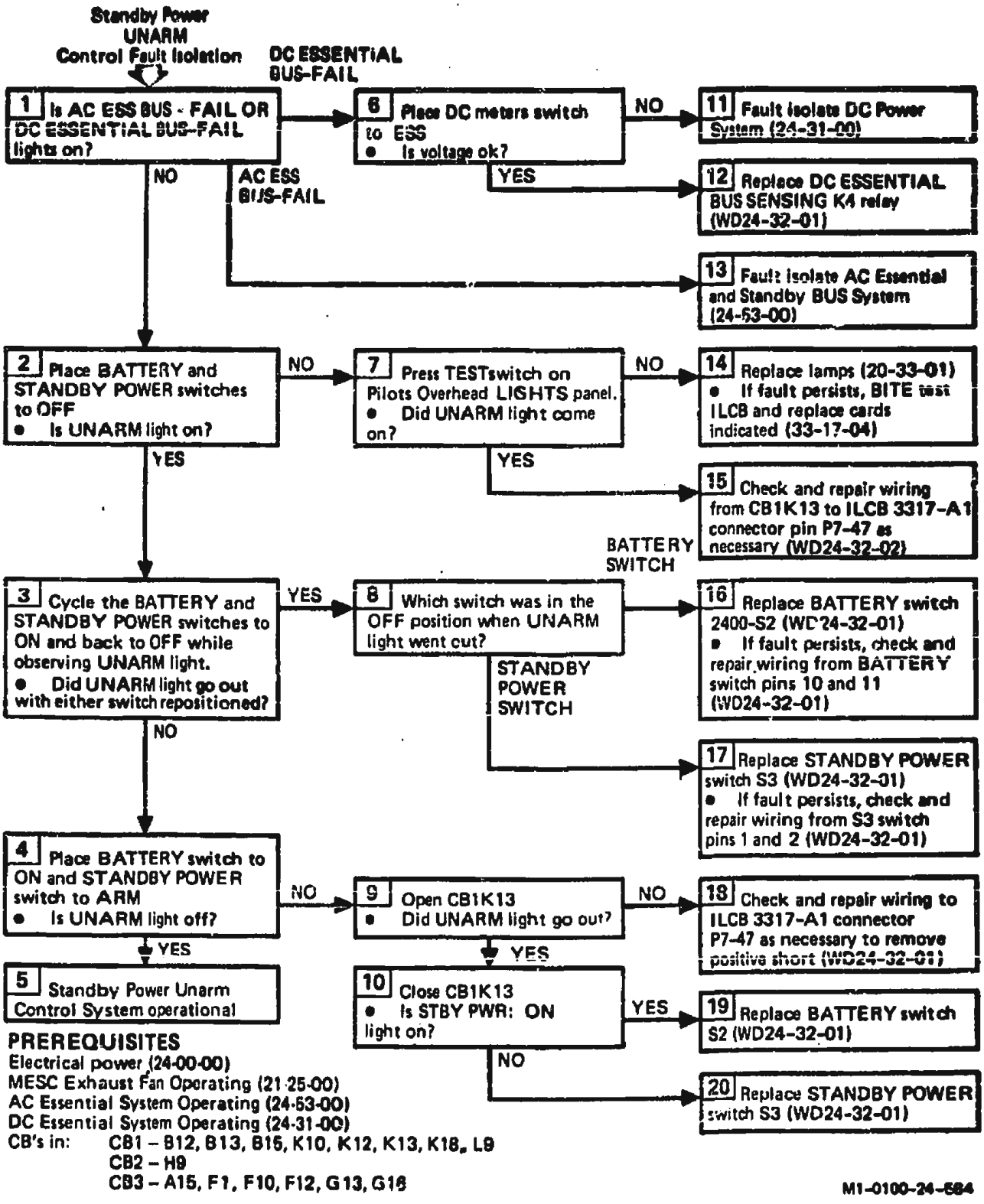
Battery Charger Control Fault Isolation
Figure 103 (Sheet 2)

PREREQUISITES
SEE SHEET 1

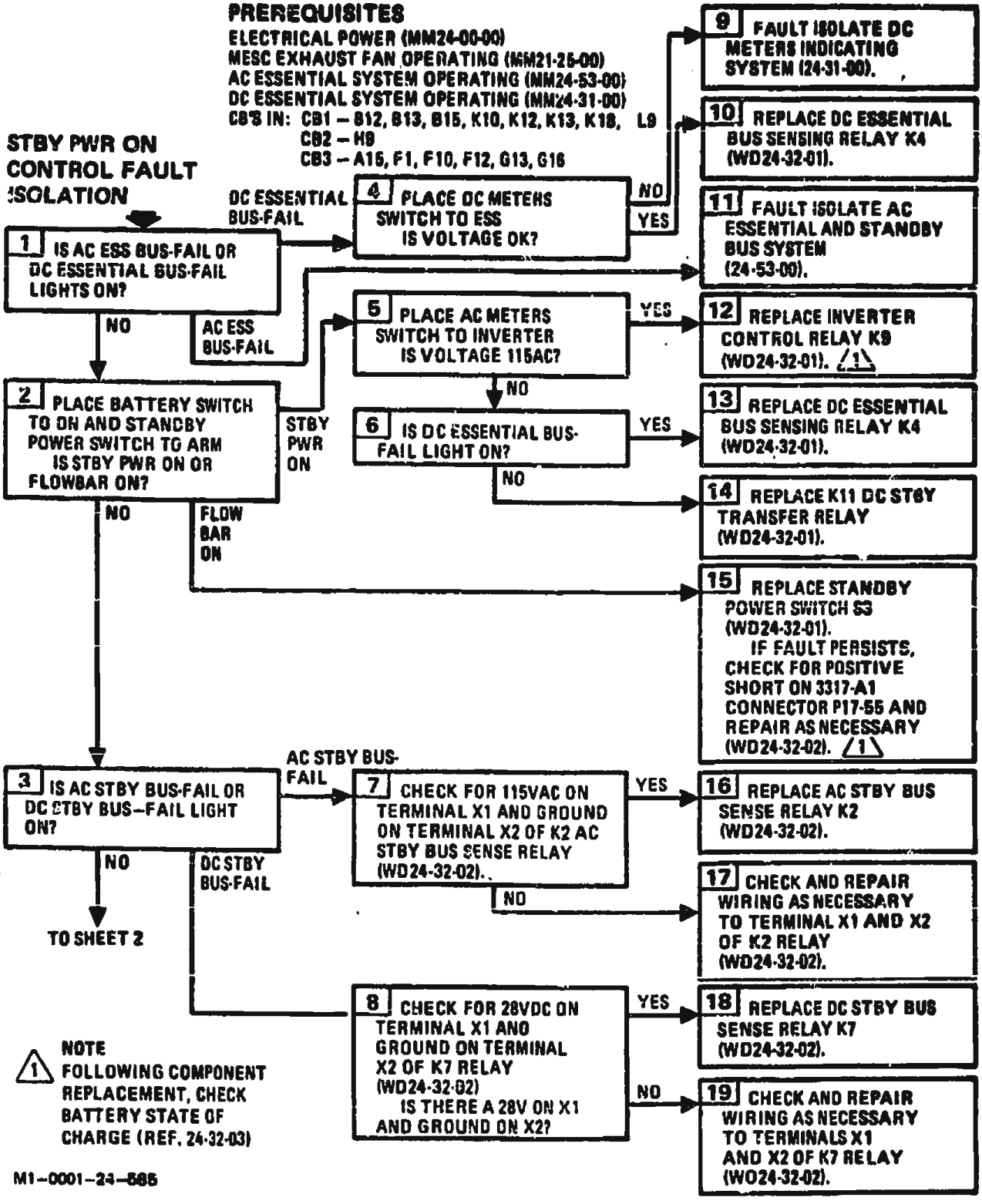

FROM SHEET 1
1 DIO BATTERY CONDITION LIGHT COME ON?
YES, AIRCRAFT AIRBORNE
NO
YES, AIRCRAFT ON GND
5 SIMULATE AIRBORNE CONDITION (MM32-63-00). IS MID OVBD LIGHT ON?
YES
NO
7 CHECK DIFF PRESSURE SENSOR SWITCH. (REFERENCE MM21-25-00). MID AVIONIC AIR COOLING PROBLEM FAULT ISOLATION DIAGRAM.
8 REPLACE DC STANDBY TRANSFER RELAY 2432-K11.
6 CHECK BATTERY COOLING FAN (MM21-25-00). IS IT OK?
YES
NO
9 CHECK BATTERY COOLING SYSTEM. (REFERENCE MM21-25-00). MID AVIONIC AIR COOLING PROBLEM FAULT ISOLATION DIAGRAM.
2 CHECK BATTERY VOLTS. WHAT IS BATTERY VOLTAGE?
<17V
10 REPLACE BATTERY (MM24-32-03).
>17V
3 CHECK FOR 115V AC ON TERMINALS A2, B2, G2 OF BATTERY CHARGER RCCB 2432-CB17 (MM21-25-02). IS 115V ON TERMINALS?
NO
11 REPLACE RCCB 2432-CB17 (MM24-50-02).
YES
4 CHECK 50 AMP CURRENT LIMITER. OPEN? (MM24-32-03)
YES
12 REPLACE LIMITER (MM24-53-04).
NO
13 CHECK AND REPAIR WIRING TO CURRENT LIMITER (MM24-32-03).

H1-0006-24-161

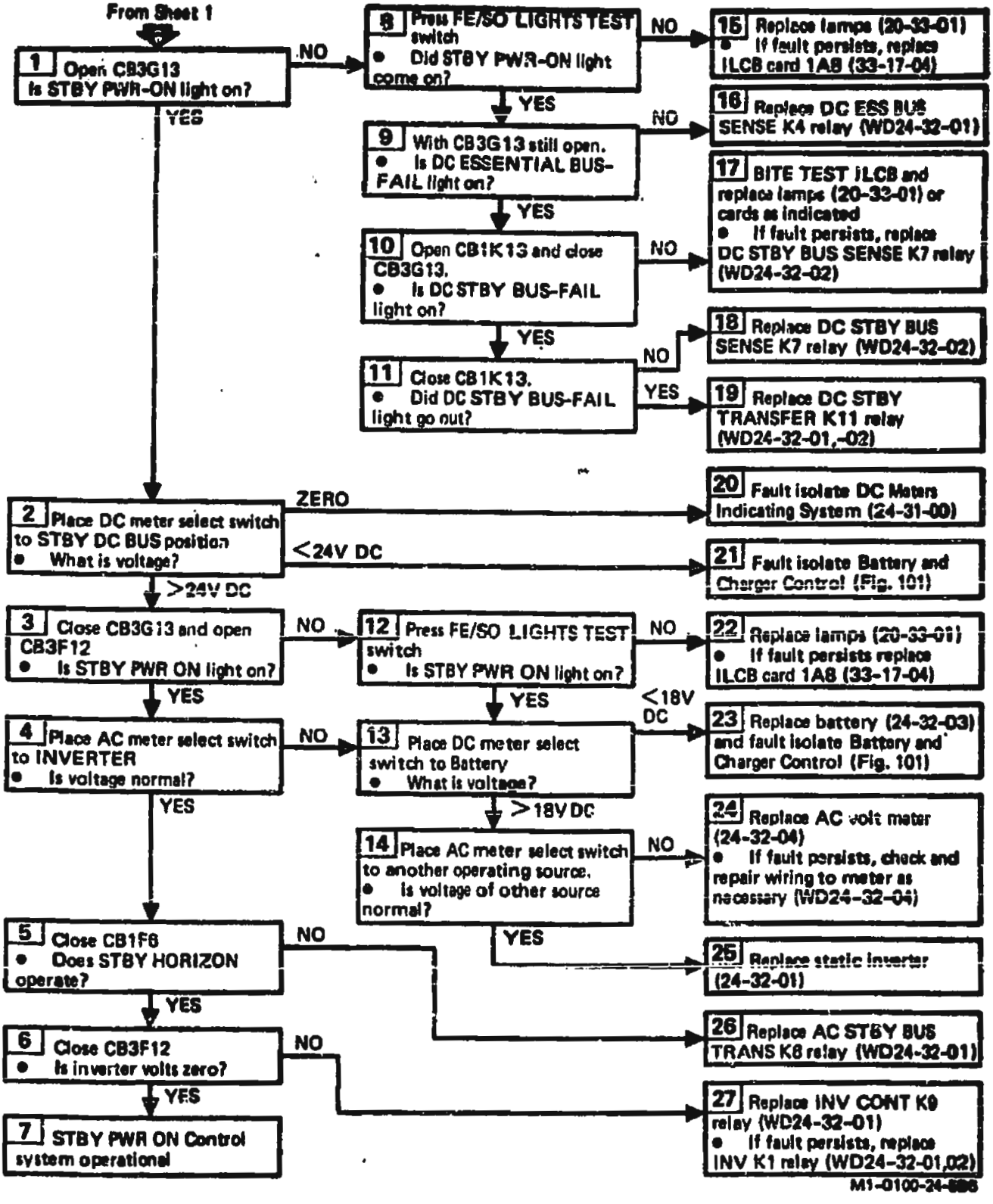
R R Battery and Charger Control Fault Isolation
Figure 103 (Sheet 3)


Standby Power UNARM Control Fault Isolation
DC ESSENTIAL BUS-FAIL
1 Is AC ESS BUS - FAIL OR DC ESSENTIAL BUS-FAIL lights on?
6 Place DC meters switch to ESS
• Is voltage ok?
NO
11 Fault isolate DC Power System (24-31-00)
YES
12 Replace DC ESSENTIAL BUS SENSING K4 relay (WD24-32-01)
NO
AC ESS BUS-FAIL
13 Fault isolate AC Essential and Standby BUS System (24-53-00)
2 Place BATTERY and STANDBY POWER switches to OFF
• Is UNARM light on?
NO
7 Press TEST switch on Pilots Overhead LIGHTS panel.
• Did UNARM light come on?
NO
14 Replace lamps (20-33-01)
• If fault persists, BITE test ILCB and replace cards indicated (33-17-04)
YES
15 Check and repair wiring from CB1K13 to ILCB 3317-A1 connector pin P7-47 as necessary (WD24-32-02)
YES
3 Cycle the BATTERY and STANDBY POWER switches to ON and back to OFF while observing UNARM light.
• Did UNARM light go out with either switch repositioned?
YES
8 Which switch was in the OFF position when UNARM light went out?
BATTERY SWITCH
16 Replace BATTERY switch 2400-S2 (WD24-32-01)
• If fault persists, check and repair wiring from BATTERY switch pins 10 and 11 (WD24-32-01)
STANDBY POWER SWITCH
17 Replace STANDBY POWER switch S3 (WD24-32-01)
• If fault persists, check and repair wiring from S3 switch pins 1 and 2 (WD24-32-01)
NO
4 Place BATTERY switch to ON and STANDBY POWER switch to ARM
• Is UNARM light off?
NO
9 Open CB1K13
• Did UNARM light go out?
NO
18 Check and repair wiring to ILCB 3317-A1 connector P7-47 as necessary to remove positive short (WD24-32-01)
YES
YES
5 Standby Power Unarm Control System operational
10 Close CB1K13
• Is STBY PWR: ON light on?
YES
19 Replace BATTERY switch S2 (WD24-32-01)
NO
20 Replace STANDBY POWER switch S3 (WD24-32-01)
PREREQUISITES
Electrical power (24-00-00)
MESC Exhaust Fan Operating (21-25-00)
AC Essential System Operating (24-53-00)
DC Essential System Operating (24-31-00)
CB's in: CB1 – B12, B13, B15, K10, K12, K13, K18, L9
CB2 – H9
CB3 – A15, F1, F10, F12, G13, G16
M1-0100-24-584

Standby Power Unarm Control Fault Isolation
Figure 104


PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
MESC EXHAUST FAN OPERATING (MM21-25-00)
AC ESSENTIAL SYSTEM OPERATING (MM24-53-00)
DC ESSENTIAL SYSTEM OPERATING (MM24-31-00)
CB'S IN: CB1 – B12, B13, B15, K10, K12, K13, K18, L9
CB2 – H9
CB3 – A15, F1, F10, F12, G13, G16
STBY PWR ON CONTROL FAULT ISOLATION
1 IS AC ESS BUS-FAIL OR DC ESSENTIAL BUS-FAIL LIGHTS ON?
NO
AC ESS BUS-FAIL
DC ESSENTIAL BUS-FAIL
4 PLACE DC METERS SWITCH TO ESS IS VOLTAGE OK?
NO
YES
9 FAULT ISOLATE DC METERS INDICATING SYSTEM (24-31-00).
10 REPLACE DC ESSENTIAL BUS SENSING RELAY K4 (WD24-32-01).
11 FAULT ISOLATE AC ESSENTIAL AND STANDBY BUS SYSTEM (24-53-00).
5 PLACE AC METERS SWITCH TO INVERTER IS VOLTAGE 115AC?
YES
12 REPLACE INVERTER CONTROL RELAY K9 (WD24-32-01). 1
NO
2 PLACE BATTERY SWITCH TO ON AND STANDBY POWER SWITCH TO ARM IS STBY PWR ON OR FLOWBAR ON?
STBY PWR ON
6 IS DC ESSENTIAL BUS-FAIL LIGHT ON?
YES
13 REPLACE DC ESSENTIAL BUS SENSING RELAY K4 (WD24-32-01).
NO
14 REPLACE K11 DC STBY TRANSFER RELAY (WD24-32-01).
NO
FLOW BAR ON
15 REPLACE STANDBY POWER SWITCH S3 (WD24-32-01).
IF FAULT PERSISTS, CHECK FOR POSITIVE SHORT ON 3317-A1 CONNECTOR P17-55 AND REPAIR AS NECESSARY (WD24-32-02). 1
AC STBY BUS-FAIL
3 IS AC STBY BUS-FAIL OR DC STBY BUS–FAIL LIGHT ON?
7 CHECK FOR 115VAC ON TERMINAL X1 AND GROUND ON TERMINAL X2 OF K2 AC STBY BUS SENSE RELAY (WD24-32-02).
YES
16 REPLACE AC STBY BUS SENSE RELAY K2 (WD24-32-02).
NO
17 CHECK AND REPAIR WIRING AS NECESSARY TO TERMINAL X1 AND X2 OF K2 RELAY (WD24-32-02).
NO
TO SHEET 2
DC STBY BUS-FAIL
8 CHECK FOR 28VDC ON TERMINAL X1 AND GROUND ON TERMINAL X2 OF K7 RELAY (WD24-32-02)
IS THERE A 28V ON X1 AND GROUND ON X2?
YES
18 REPLACE DC STBY BUS SENSE RELAY K7 (WD24-32-02).
NO
19 CHECK AND REPAIR WIRING AS NECESSARY TO TERMINALS X1 AND X2 OF K7 RELAY (WD24-32-02).
1 NOTE
FOLLOWING COMPONENT REPLACEMENT, CHECK BATTERY STATE OF CHARGE (REF. 24-32-03)
M1-0001-24-585

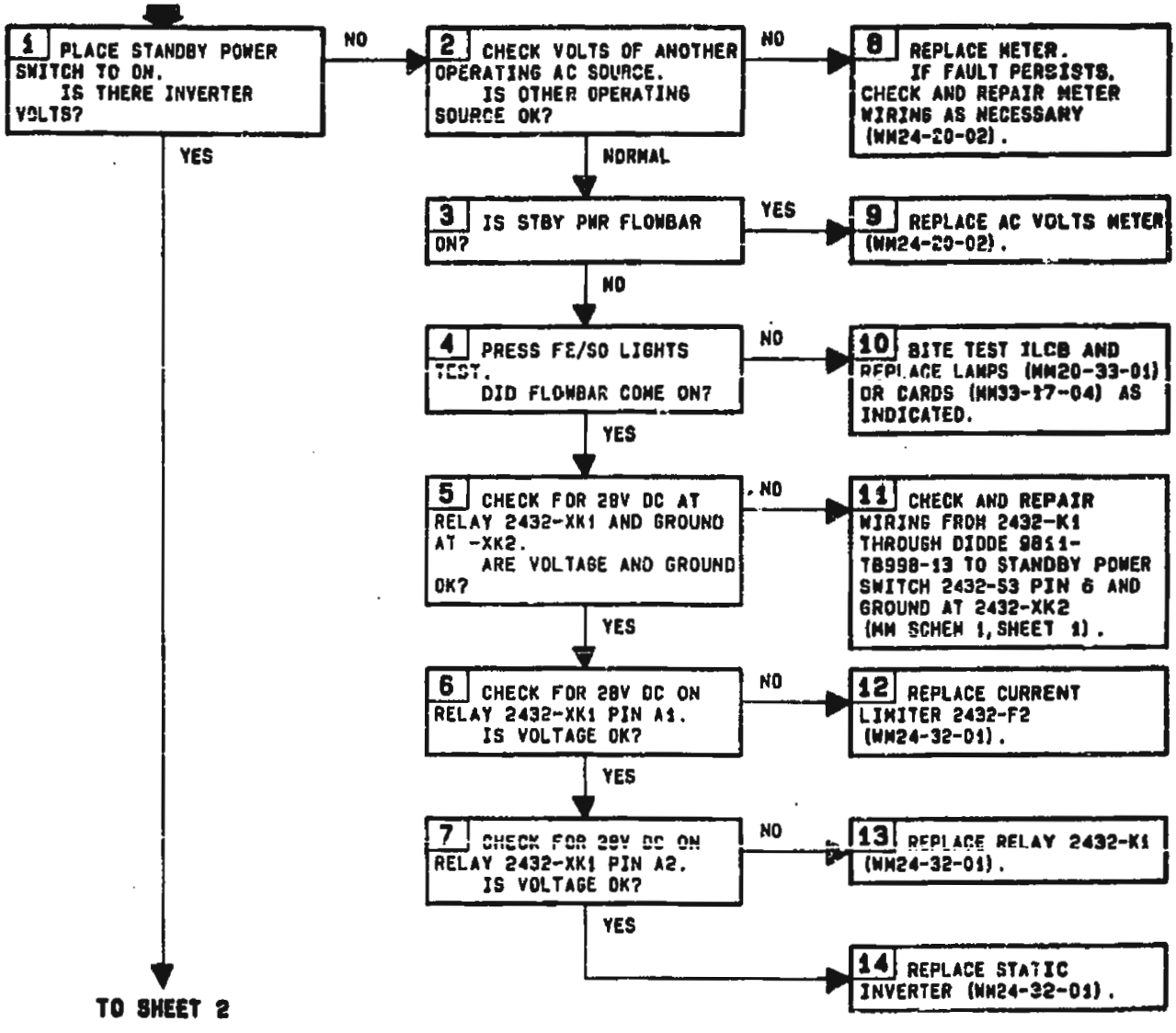
STBY PWR ON Control Fault Isolation
Figure 105 (Sheet 1)


From Sheet 1
1 Open CB3G13
Is STBY PWR-ON light on?
NO
YES
8 Press FE/SO LIGHTS TEST switch
• Did STBY PWR-ON light come on?
NO
YES
15 Replace lamps (20-33-01)
• If fault persists, replace ILCB card 1A8 (33-17-04)
9 With CB3G13 still open.
• Is DC ESSENTIAL BUS-FAIL light on?
NO
YES
16 Replace DC ESS BUS SENSE K4 relay (WD24-32-01)
10 Open CB1K13 and close CB3G13.
• Is DC STBY BUS-FAIL light on?
NO
YES
17 BITE TEST ILCB and replace lamps (20-33-01) or cards as indicated
• If fault persists, replace DC STBY BUS SENSE K7 relay (WD24-32-02)
11 Close CB1K13.
• Did DC STBY BUS-FAIL light go out?
NO
YES
18 Replace DC STBY BUS SENSE K7 relay (WD24-32-02)
19 Replace DC STBY TRANSFER K11 relay (WD24-32-01,-02)
2 Place DC meter select switch to STBY DC BUS position
• What is voltage?
ZERO
<24V DC
>24V DC
20 Fault isolate DC Meters Indicating System (24-31-00)
21 Fault isolate Battery and Charger Control (Fig. 101)
3 Close CB3G13 and open CB3F12
• Is STBY PWR ON light on?
NO
YES
12 Press FE/SO LIGHTS TEST switch
• Is STBY PWR ON light on?
NO
YES
22 Replace lamps (20-33-01)
• If fault persists replace ILCB card 1A8 (33-17-04)
4 Place AC meter select switch to INVERTER
• Is voltage normal?
NO
YES
13 Place DC meter select switch to Battery
• What is voltage?
<18V DC
>18V DC
23 Replace battery (24-32-03) and fault isolate Battery and Charger Control (Fig. 101)
14 Place AC meter select switch to another operating source.
• Is voltage of other source normal?
NO
YES
24 Replace AC volt meter (24-32-04)
• If fault persists, check and repair wiring to meter as necessary (WD24-32-04)
5 Close CB1F6
• Does STBY HORIZON operate?
NO
YES
25 Replace static inverter (24-32-01)
6 Close CB3F12
• Is inverter volts zero?
NO
YES
26 Replace AC STBY BUS TRANS K8 relay (WD24-32-01)
7 STBY PWR ON Control system operational
27 Replace INV CONT K9 relay (WD24-32-01)
• If fault persists, replace INV K1 relay (WD24-32-01,02)
M1-0100-24-000

STBY PWR ON Control Fault Isolation
Figure 105 (Sheet 2)

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
MESC EXHAUST FAN OPERATING (MM21-25-00)
AC ESSENTIAL SYSTEM OPERATING (MM24-63-00)
DC ESSENTIAL SYSTEM OPERATING (MM24-31-00)
BATTERY CHARGE MODE SELECT SWITCH IN NORM POSITION (CB3-K2)
CB'S IN: CB1-B12, B13, K10, K12, K13, K18
CB2-H9
CB3-A15, F1, F12, G13, G18
GALLEY LEFT - D14

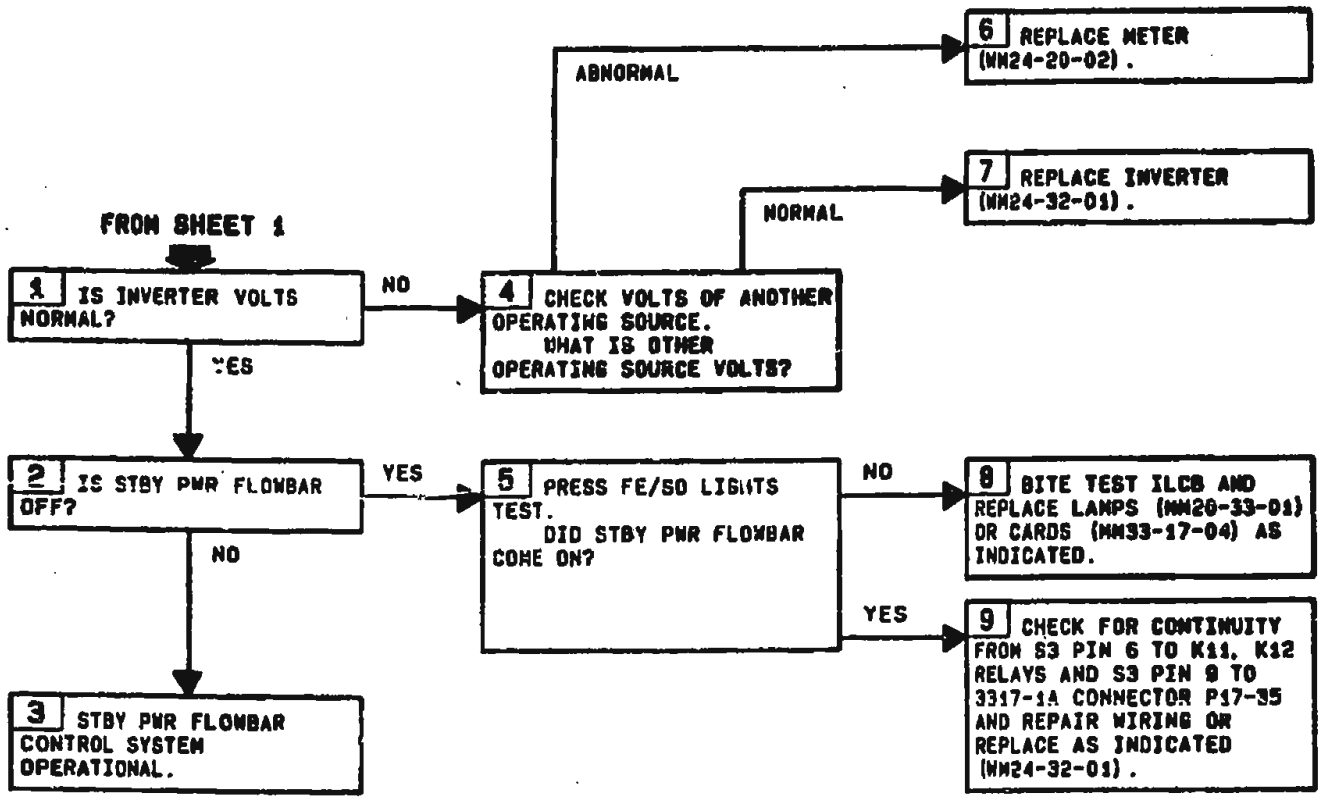
STBY PWR FLOWBAR CONT FAULT ISOLATION


1 PLACE STANDBY POWER SWITCH TO ON. IS THERE INVERTER VOLTS?
NO
2 CHECK VOLTS OF ANOTHER OPERATING AC SOURCE. IS OTHER OPERATING SOURCE OK?
NO
8 REPLACE METER. IF FAULT PERSISTS, CHECK AND REPAIR METER WIRING AS NECESSARY (MM24-20-02).
YES
NORMAL
3 IS STBY PWR FLOWBAR ON?
YES
9 REPLACE AC VOLTS METER (MM24-20-02).
NO
4 PRESS FE/SO LIGHTS TEST. DID FLOWBAR COME ON?
NO
10 BITE TEST ILCB AND REPLACE LAMPS (MM20-33-01) OR CARDS (MM33-17-04) AS INDICATED.
YES
5 CHECK FOR 28V DC AT RELAY 2432-XK1 AND GROUND AT -XK2. ARE VOLTAGE AND GROUND OK?
NO
11 CHECK AND REPAIR WIRING FROM 2432-K1 THROUGH DIODE 9811-TB998-13 TO STANDBY POWER SWITCH 2432-S3 PIN 6 AND GROUND AT 2432-XK2 (MM SCHEM 1, SHEET 1).
YES
6 CHECK FOR 28V DC ON RELAY 2432-XK1 PIN A1. IS VOLTAGE OK?
NO
12 REPLACE CURRENT LIMITER 2432-F2 (MM24-32-01).
YES
7 CHECK FOR 28V DC ON RELAY 2432-XK1 PIN A2. IS VOLTAGE OK?
NO
13 REPLACE RELAY 2432-K1 (MM24-32-01).
YES
14 REPLACE STATIC INVERTER (MM24-32-01).
TO SHEET 2

M1-0000-24-1243

R STBY PWR Flowbar Control Fault Isolation
R Figure 106 (Sheet 1)

PREREQUISITES
SEE SHEET 1

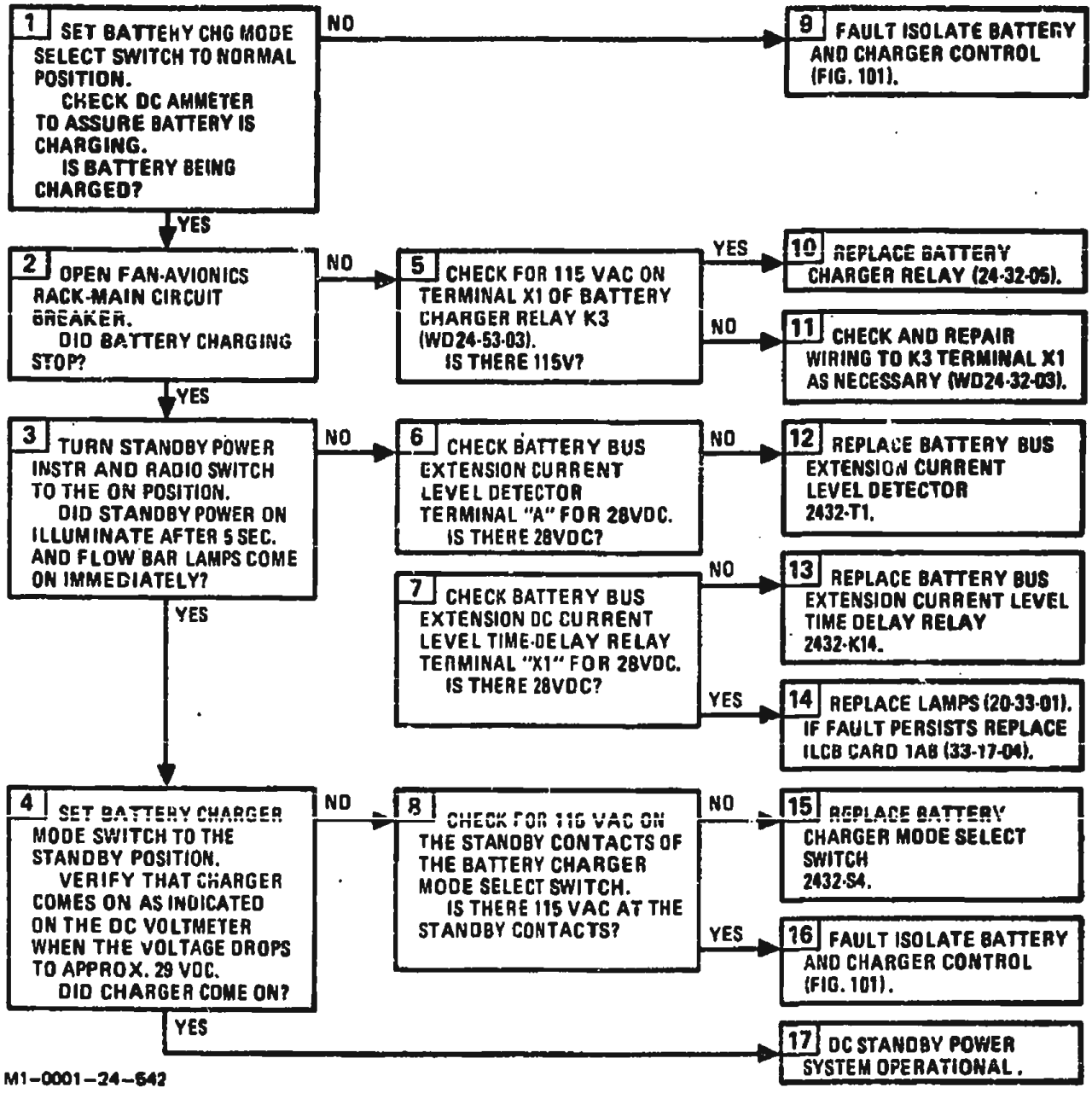

FROM SHEET 1
1 IS INVERTER VOLTS NORMAL?
NO
YES
4 CHECK VOLTS OF ANOTHER OPERATING SOURCE. WHAT IS OTHER OPERATING SOURCE VOLTS?
ABNORMAL
NORMAL
6 REPLACE METER (MM24-20-02).
7 REPLACE INVERTER (MM24-32-01).
2 IS STBY PWR FLOWBAR OFF?
YES
NO
5 PRESS FE/SO LIGHTS TEST. DID STBY PWR FLOWBAR COME ON?
NO
YES
8 BITE TEST ILCB AND REPLACE LAMPS (MM20-33-01) OR CARDS (MM33-17-04) AS INDICATED.
9 CHECK FOR CONTINUITY FROM S3 PIN 6 TO K11, K12 RELAYS AND S3 PIN 9 TO 3317-1A CONNECTOR P17-35 AND REPAIR WIRING OR REPLACE AS INDICATED (MM24-32-01).
3 STBY PWR FLOWBAR CONTROL SYSTEM OPERATIONAL.

H1-0002-24-587

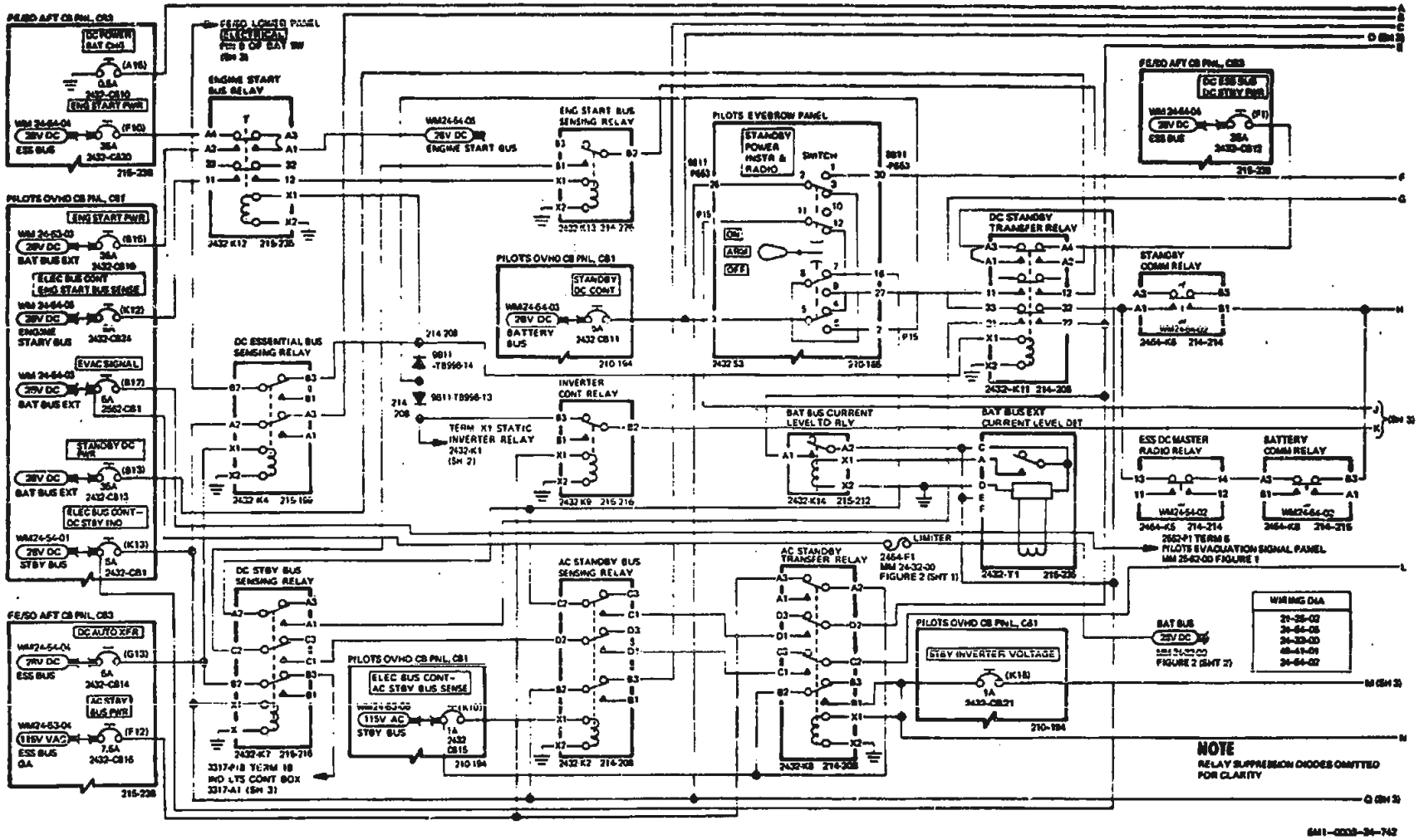
R STBY PWR Flowbar Control Fault Isolation
R Figure 106 (Sheet 2)

PREREQUISITES

ELECTRICAL POWER (MM24-00-00)
MESC EXHAUST FAN OPERATING (MM21-25-00)
AC ESSENTICAL SYSTEM OPERATING (MM24-53-00)
DC ESSENTIALSYSTEM OPERATING (MM24-31-00)
BATTERY CHARGE MODE SELECT SWITCH IN NORM POSITION (CB3-K2)
CB'S IN:CB1 - B12,B13, K10, K12, K13, K15
CB2 - H9
CB3 - A15, F1, F12, G13, G16
GALLEY LEFT - D14


1 SET BATTEHY CHG MODE SELECT SWITCH TO NORMAL POSITION. CHECK DC AMMETER TO ASSURE BATTERY IS CHARGING. IS BATTERY BEING CHARGED?
NO
9 FAULT ISOLATE BATTERY AND CHARGER CONTROL (FIG. 101).
YES
2 OPEN FAN-AVIONICS RACK-MAIN CIRCUIT BREAKER. DID BATTERY CHARGING STOP?
NO
5 CHECK FOR 115 VAC ON TERMINAL X1 OF BATTERY CHARGER RELAY K3 (WD24-53-03). IS THERE 115V?
YES
10 REPLACE BATTERY CHARGER RELAY (24-32-05).
NO
11 CHECK AND REPAIR WIRING TO K3 TERMINAL X1 AS NECESSARY (WD24-32-03).
YES
3 TURN STANDBY POWER INSTR AND RADIO SWITCH TO THE ON POSITION. DID STANDBY POWER ON ILLUMINATE AFTER 5 SEC. AND FLOW BAR LAMPS COME ON IMMEDIATELY?
NO
6 CHECK BATTERY BUS EXTENSION CURRENT LEVEL DETECTOR TERMINAL "A" FOR 28VDC. IS THERE 28VDC?
NO
12 REPLACE BATTERY BUS EXTENSION CURRENT LEVEL DETECTOR 2432-T1.
7 CHECK BATTERY BUS EXTENSION DC CURRENT LEVEL TIME-DELAY RELAY TERMINAL "X1" FOR 28VDC. IS THERE 28VDC?
NO
13 REPLACE BATTERY BUS EXTENSION CURRENT LEVEL TIME DELAY RELAY 2432-K14.
YES
14 REPLACE LAMPS (20-33-01). IF FAULT PERSISTS REPLACE ILCB CARD 1A8 (33-17-04).
YES
4 SET BATTERY CHARGER MODE SWITCH TO THE STANDBY POSITION. VERIFY THAT CHARGER COMES ON AS INDICATED ON THE DC VOLTMETER WHEN THE VOLTAGE DROPS TO APPROX. 29 VDC. DID CHARGER COME ON?
NO
8 CHECK FOR 115 VAC ON THE STANDBY CONTACTS OF THE BATTERY CHARGER MODE SELECT SWITCH. IS THERE 115 VAC AT THE STANDBY CONTACTS?
NO
15 REPLACE BATTERY CHARGER MODE SELECT SWITCH 2432-S4.
YES
16 FAULT ISOLATE BATTERY AND CHARGER CONTROL (FIG. 101).
YES
17 DC STANDBY POWER SYSTEM OPERATIONAL.
M1-0001-24-642

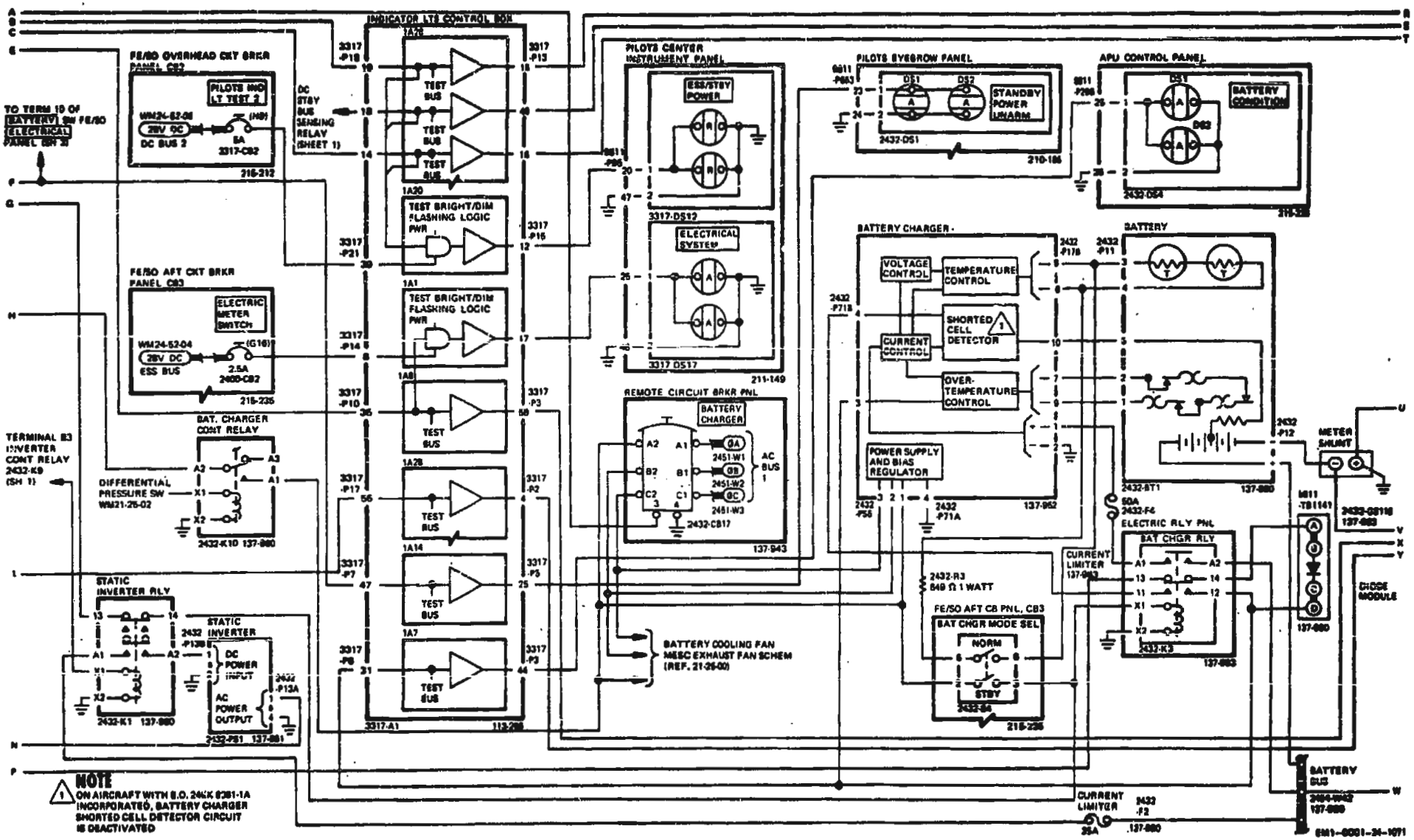
Battery Charger Powered Standby Bus Fault Isolation
Figure 107



R Standby Power System Schematic
R SCHEM 1 (Sheet 1)

EFFECTIVITY: 001-031

001B

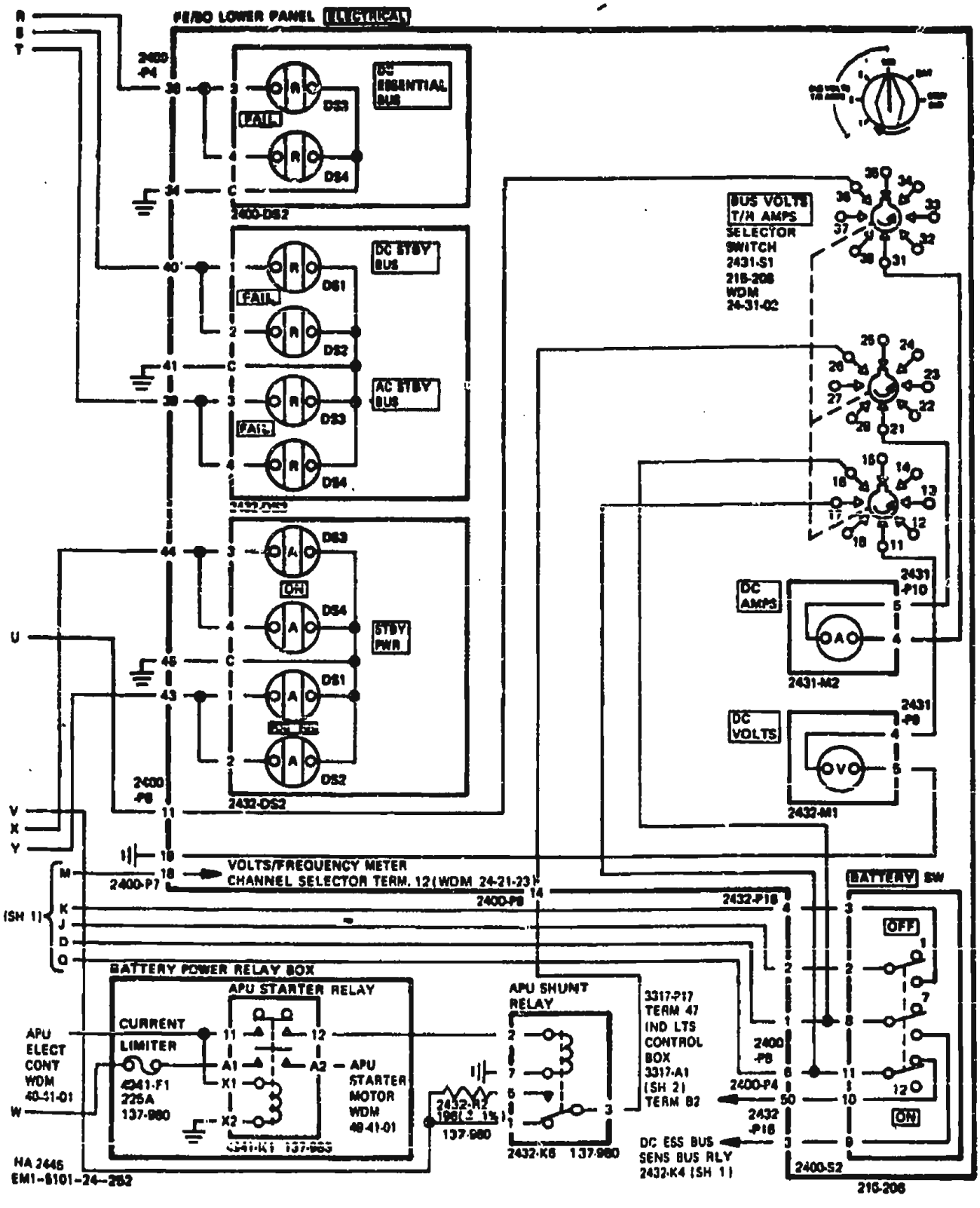


CR
CR

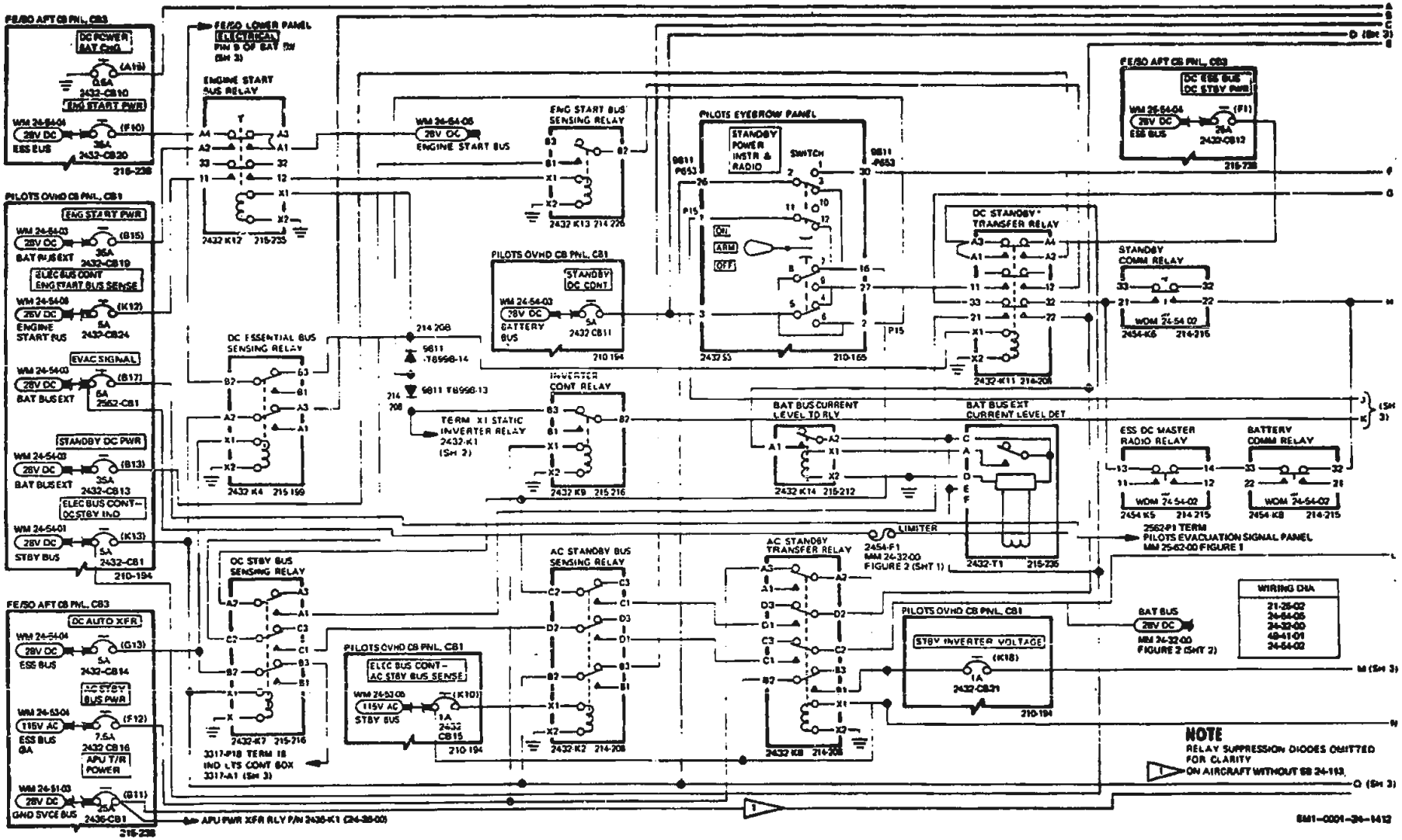
Standby Power System Schematic
SCHEM 1 (Sheet 2)

EFFECTIVITY: 001-031

001B



Standby Power System Schematic
SCHEM 1 (Sheet 3)

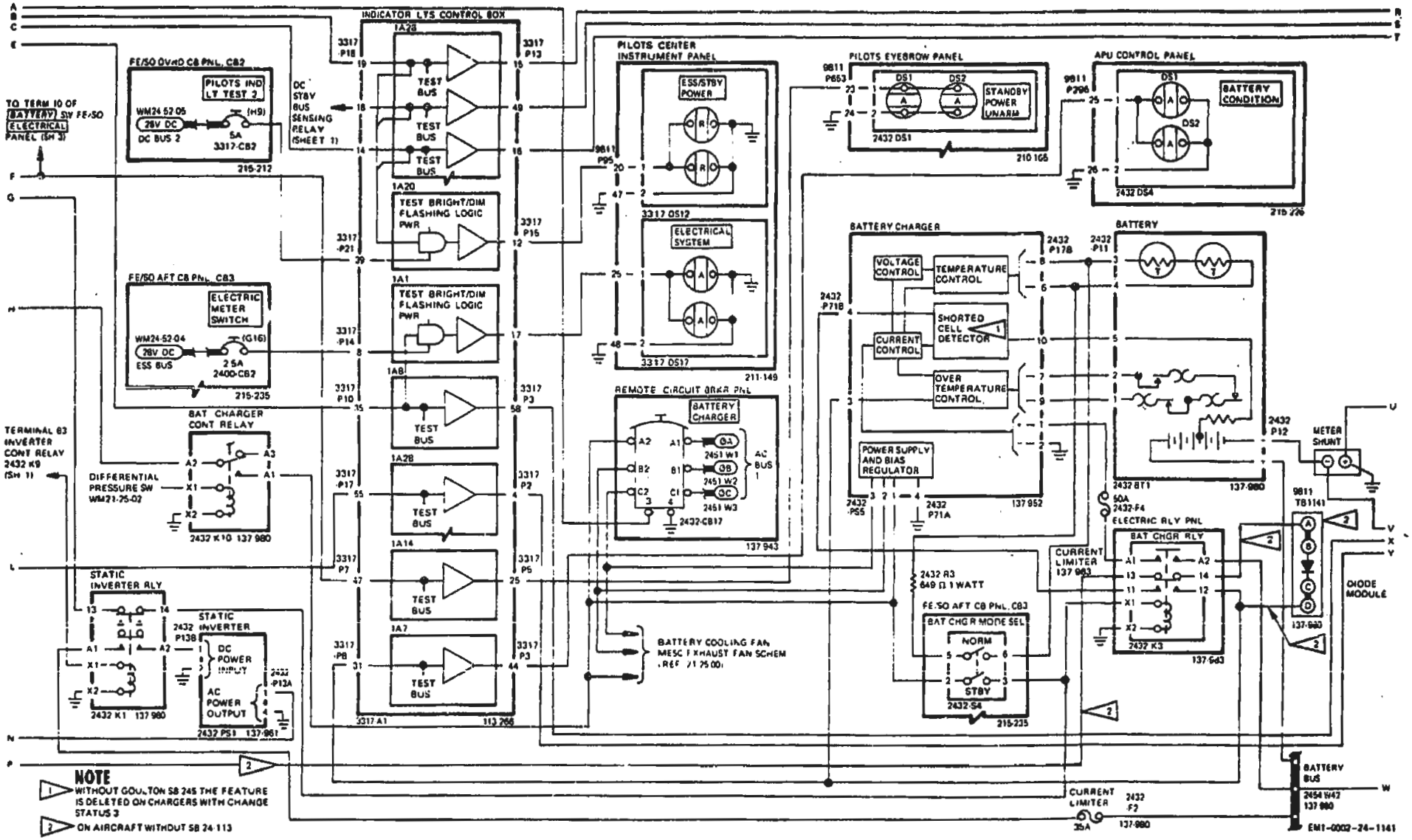


R
R

Standby Power System Schematic
SCHEM 1 (Sheet 1)

EFFECTIVITY: 032-999

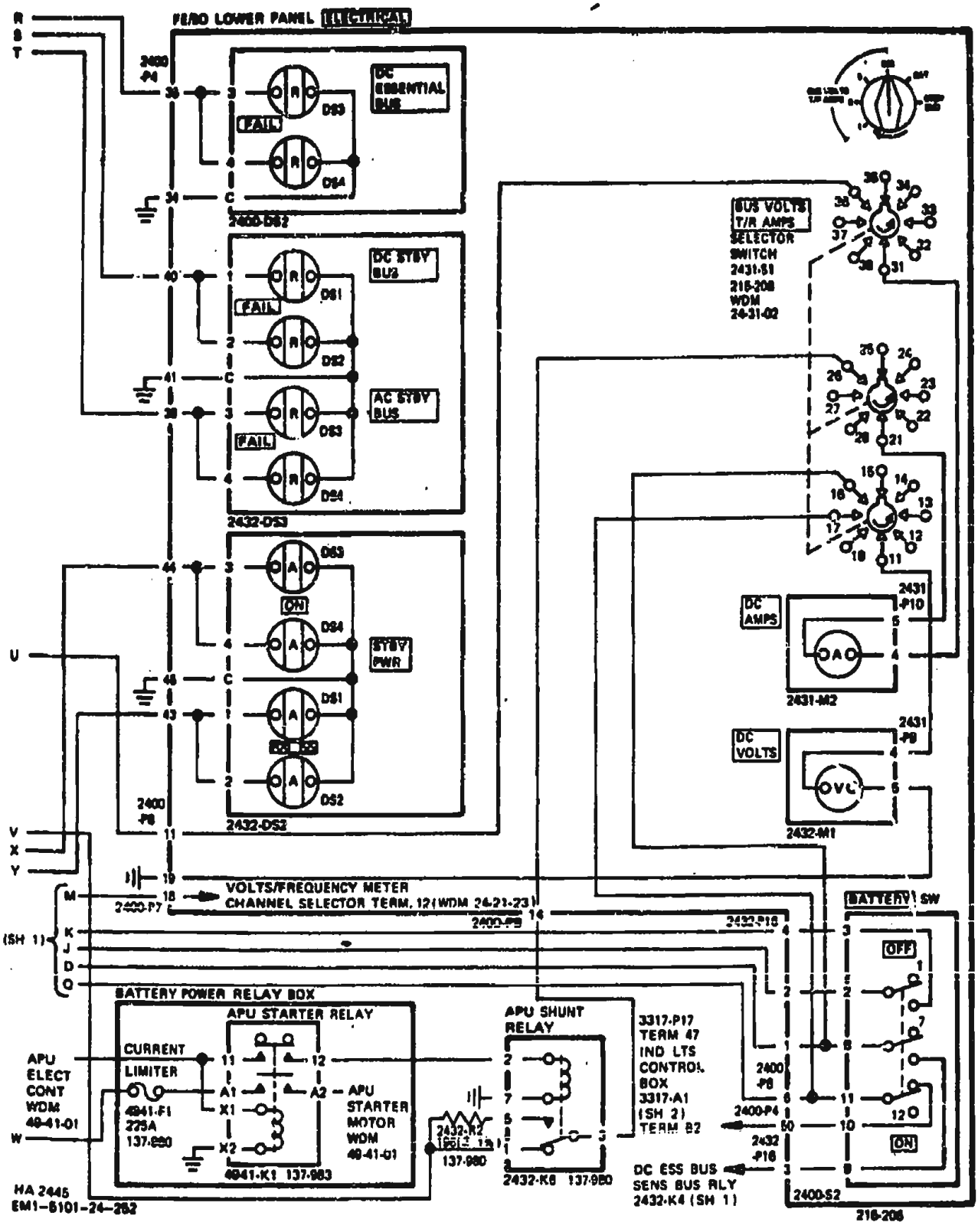
001B


INDICATOR LTS CONTROL BOX
PILOTS CENTER INSTRUMENT PANEL
PILOTS EYEBROW PANEL
APU CONTROL PANEL
FE/SO OVHD CB PNL, CB2
FE/SO AFT CB PNL, CB3
BATTERY CHARGER
BATTERY
REMOTE CIRCUIT BRKR PNL
BAT CHARGER CONT RELAY
STATIC INVERTER RLY
STATIC INVERTER
ELECTRIC RLY PNL
BAT CHGR RLY
BAT CHGR MODE SEL
TEST BUS
TEST BRIGHT/DIM FLASHING LOGIC PWR
ESS/STBY POWER
ELECTRICAL SYSTEM
VOLTAGE CONTROL
TEMPERATURE CONTROL
CURRENT CONTROL
SHORTED CELL DETECTOR
OVER TEMPERATURE CONTROL
POWER SUPPLY AND BIAS REGULATOR
BATTERY CONDITION
STANDBY POWER UNARM
DIFFERENTIAL PRESSURE SW WM21-75-02
TERMINAL 63 INVERTER CONT RELAY 2432 K9 (SH 1)
TO TERM 10 OF BATT(EAV) SW FE/SO ELECTRICAL PANEL (SH 3)
OC STBY BUS SENSING RELAY (SHEET 1)
BATTERY COOLING FAN MISC EXHAUST FAN SCHEM REF 21-75-00
CURRENT LIMITER 137 963
DIODE MODULE
METER SHUNT
BATTERY BUS
NOTE
1 WITHOUT GOULTON SB 245 THE FEATURE IS DELETED ON CHARGERS WITH CHANGE STATUS 3
2 ON AIRCRAFT WITHOUT SB 24-113

CR Standby Power System Schematic
CR SCHEM 1 (Sheet 2)

EFFECTIVITY: 032-999

001B



Standby Power System Schematic
SCHEM 1 (Sheet 3)

STANDBY POWER SYSTEM - ADJUSTMENT AND TEST

1. General

R Paragraph 4A provides an operational test of the standby power
R system, and paragraph 4B is a procedure for checking the battery charging system.

The standby power system is not adjustable on the aircraft. If, during the test procedure, the ac and/or dc voltages are not within prescribed limits, the static inverter or battery must be removed from the aircraft and serviced in the shop. The battery should be allowed time to respond to normal charging before removal.

Under normal operating conditions, whenever the battery is less than 85 percent fully charged, the DC AMPS indicator on the Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, will indicate a steady negative 40 amperes. When the battery is 80 to 100 percent charged, the charger operates in a pulse charging mode (Ref. Figure 501). In this mode, the indicator pointer pulsates in the area of zero to a negative 40 amperes. Normally, a low or dead battery is fully charged in 90 minutes. A positive DC AMPS indication signifies battery current drain and a non-operative battery charger.

2. Referenced Procedure

24-00-00 Electrical Power - Maintenance Practices

3. Equipment and Materials

Digital Ohmmeter, Model 77, John Fluke Mfg. Co., Inc., or equivalent

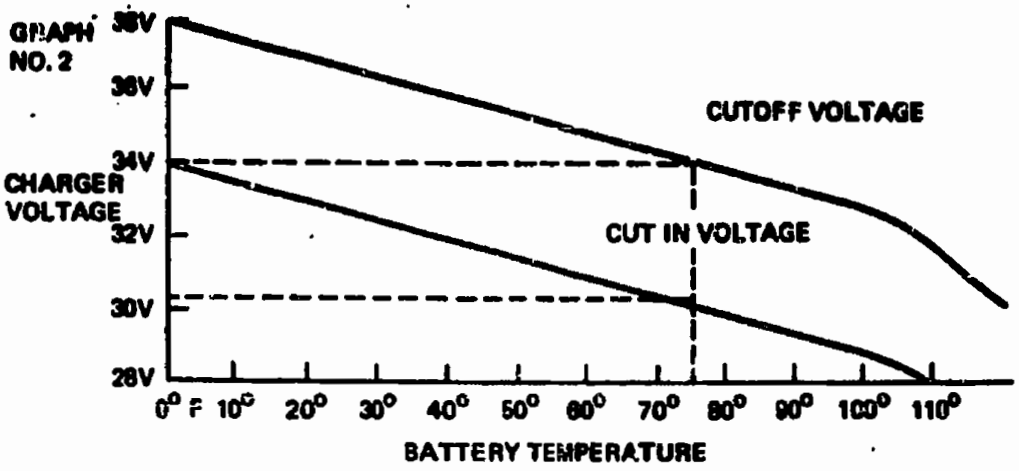
4. Adjustment/Test

A. Standby Power System Operational Test

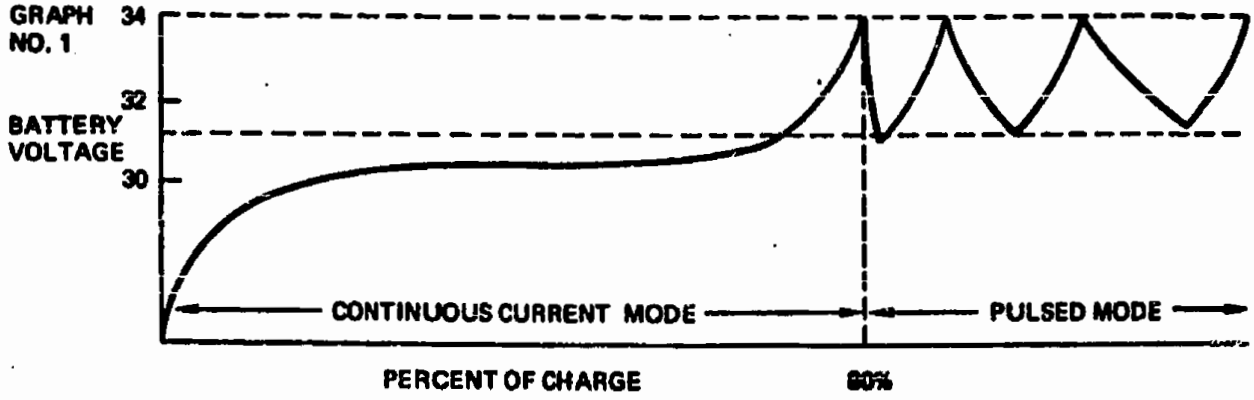
(1) Verify that external power source and all generators are turned off (Ref. 24-00-00).

(2) Verify that battery is installed and connected.

(3) Verify that STANDBY POWER - INSTR & RADIO switch on eyebrow panel, zone 210, is in OFF position.



NOTE: BATTERY CHARGER OUTPUT CURRENT IS 40 AMPS ± 2 FOR CONTINUOUS OR PULSED MODE OF OPERATION



BATTERY CHARGER OUTPUT

M1-0001-24-1147

Battery Charger Output
Figure 501

R
R
0018 EFFECTIVITY: ALL

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that BATTERY CHARGER MODE switch is in NORMAL position.

R NOTE: On aircraft 032-999 without SB24-113, a BATTERY CONDITION warning light, will come on during check of standby power system. This light warns of a condition which could discharge battery and normally illuminates when battery charger relay is de-energized.

(4) Place BATTERY switch on ELECTRICAL panel, zone 215, in ON position and verify that following lights respond as noted:

(a) UNARM light on eyebrow panel is on.

(b) STBY PWR ON light on ELECTRICAL panel will illuminate after a 5 second time delay.

(c) STBY PWR on light (flow bar) on ELECTRICAL panel is off.

(d) AC STBY BUS FAIL light on ELECTRICAL panel is on.

(e) AC ESS BUS FAIL light on ELECTRICAL panel is on.

(f) DC STBY BUS FAIL light on ELECTRICAL panel is off.

(g) DC ESSENTIAL BUS FAIL light on ELECTRICAL panel is on.

(5) Place BUS VOLTS - T/R AMPS selector switch on ELECTRICAL panel in STBY DC BUS position and verify 22.0 to 30.5 volts on adjacent DC VOLTS meter.

(6) Place STANDBY POWER - INSTR & RADIO switch in ARM position and verify that following lights respond as noted:

(a) UNARM light is off.

(b) STBY PWR ON light is ON.

(c) AC and DC STBY BUS FAIL lights are off.

(d) AC ESS BUS FAIL light is on.

(e) DC ESSENTIAL BUS FAIL light is on.

(f) STBY PWR on light (flow bar) is off.

(7) On ELECTRICAL panel, rotate volts frequency channel selector switch to INVERTER position and verify 400(±10) Hz on adjacent FREQ meter. Verify 112.5 to 119.5 volts on adjacent AC VOLTS meter.

(8) Place STANDBY POWER-INSTR & RADIO SWITCH in on position. Verify that flowbar light comes on and that all other indicators remain unchanged.

(9) Place BATTERY switch in OFF position and verify that UNARM light comes on.

(10) Place STANDBY POWER - INSTR & RADIO switch in OFF position.

B. Battery Charging System Check

(1) Turn on electrical power (Ref. 24-00-00).

(2) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, verify that circuit breakers BAT CHG INTLK and MLG GND SENSE (L6 and L8) are closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breaker BAT CHG (A15) is closed.

On galley left circuit breaker panel, zone 130, verify that circuit breaker FAN AVIONICS RACK MAIN (D14) is closed.

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that BATTERY CHARGER MODE switch is in NORMAL position.

(3) Place BUS VOLTS - T/R AMPS selector switch on Flight Engineer/Second Officers ELECTRICAL panel in BAT position.

(4) Momentarily place STANDBY POWER - INSTR & RADIO switch in ON position and verify a positive indication on DC AMPS indicator. Place switch in OFF position.

(5) Allow battery to charge until DC AMPS indicator reverts to a pulsating mode which indicates battery charging system is operating normally.

(6) Turn off electrical power.

R **NOTE:** If the battery charging system operation is abnormal check the resistance of the battery thermistor (Ref. Step 4D).

Battery Resistance Check
Table 501

Battery Temperature	Thermistor Resistance
50 Deg. F.	4000 OHMS
55 Deg. F.	3500 OHMS
60 Deg. F.	3000 OHMS
65 Deg. F.	2600 OHMS
70 Deg. F.	2300 OHMS
75 Deg. F.	2000 OHMS
80 Deg. F.	1800 OHMS
85 Deg. F.	1600 OHMS
90 Deg. F.	1400 OHMS
95 Deg. F.	1300 OHMS
100 Deg.	1200 OHMS

C. Battery Charger Powered Standby System Check

(1) Verify that battery is installed and connected.

(2) Verify that BATTERY CHARGER MODE switch on Flight Engineer/Second Officers circuit breaker panel CB3, zone 215, is set in NORMAL position.

(3) Check dc ammeter on Flight Engineer/Second Officers electrical panel to assure that battery is charging.

(4) Open and tag FAN-AVIONICS MAIN (D14) circuit breaker on galley left circuit breaker panel, zone 130.

(5) On dc ammeter verify that battery charging stops.

(6) Operate STBY POWER - INSTR & RADIO switch on eyebrow panel, zone 210, to ON. The STBY POWER ON and FLOWBAR IND. LAMPS shall light.

(7) Operate BATTERY CHARGER MODE switch to STBY position. When battery voltage as indicated on dc voltmeter drops to approximately 29 volts, the charger comes on as indicated on dc ammeter.

(8) Operate BATTERY CHARGER MODE switch to NORMAL position, STBY POWER - INSTR & RADIO switch to OFF and CLOSE FAN-AVIONICS MAIN circuit breaker.

(9) Turn off electrical power (Ref. 24-00-00).

R D. Battery Thermistor Check

R (1) Disconnect battery sensor connector (2432-P11).

R (2) Turn on electrical system (Ref. 24-00-00).

R (3) Using low power digital ohmmeter measure thermistor
R resistance between battery connector J2, pins 3 and 4.

R (4) The thermistor resistance is dependent on battery
R temperature (Ref. Table 501). If the thermistor
R resistance is abnormal, replace the battery.

R (5) Turn off electrical power (Ref. 24-00-00).

R (6) Reconnect battery connector.

STATIC INVERTER - REMOVAL AND INSTALLATION

1. Reference Procedures

6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
6-50-00	Interior Access Doors and Removable Panels - Description and Operation

2. Removal/Installation

A. Removal

(1) Ensure that BATTERY switch on Flight Engineer/Second Officers electrical control panel, zone 215, is in OFF position and tagged.

(2) Ensure that STANDBY POWER INSTR & RADIO switch on eyebrow panel, zone 210, is in OFF position and tagged.

(3) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breaker STANDBY DC-CONT (B12).

(4) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

R WARNING: HIGH VOLTAGES CAN BE FATAL.

(5) Locate inverter on left equipment rack. Release holddown extractors on inboard end of inverter (Ref. Fig. 401) by turning counterclockwise. (Extractor removes inverter from electrical connectors.)

(6) Pull inverter (weighs 18 lb) from rack.

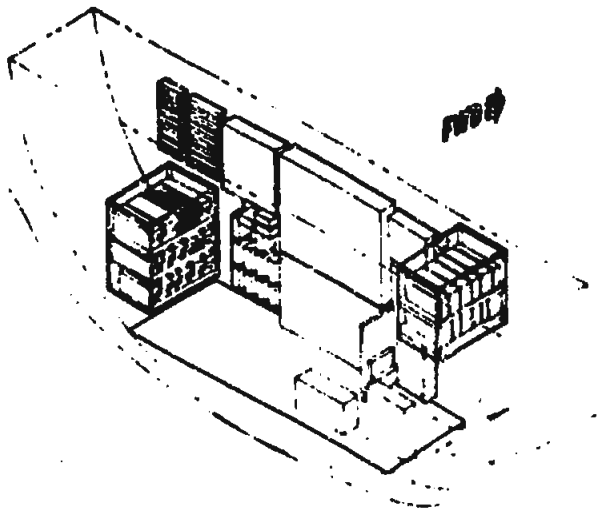
B. Installation

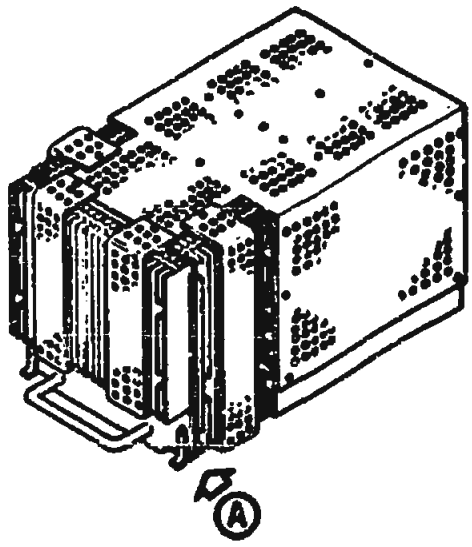
(1) Verify that circuit breaker opened in Step 1A(3) is open and tagged.

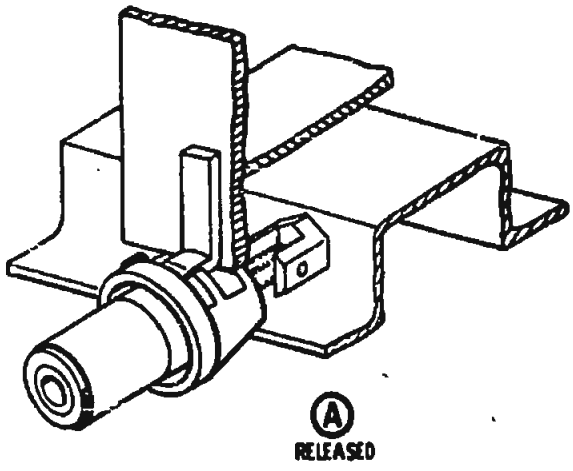
(2) Ensure that STANDBY POWER INSTR & RADIO switch is in OFF position and tagged.

(3) Ensure that BATTERY switch is in OFF position and tagged.

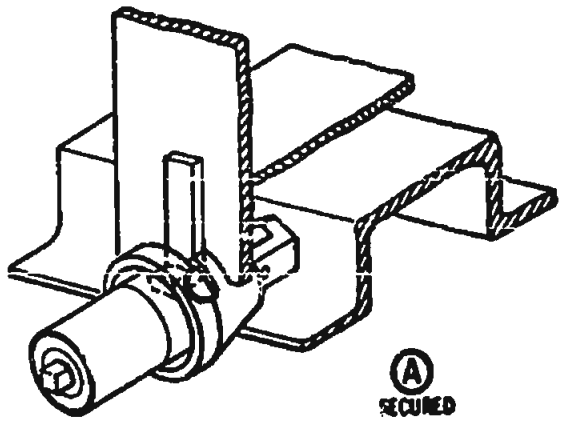
(4) Place inverter in space provided on rack, and engage holddown extractors.







NOTE
INDICATOR SIDE EXPOSED WHEN HOLD DOWN IS NOT UNDER TENSION. SIDE OF INDICATOR IS COLORED RED



NOTE
RED COLORED SIDE OF INDICATOR OUT OF VIEW WHEN EXTRACTOR HOLD DOWN IS HOLDING EQUIPMENT IN PLACE WITH PROPER FORCE

HH 6964
M1-A00-24-109

Static Inverter - Removal and Installation
Figure 401

NOTE: Indicator (red) side is exposed when holddown is disengaged or is not tight.

(5) Turn holddown extractors clockwise until proper tension is obtained.

NOTE: Red side of indicator is out of view when extractor is holding inverter in place with proper tension.

(6) Remove all tags, close circuit breaker opened in Step 1A(3), and place STANDBY POWER INSTR & RADIO switch in ON position.

NOTE: Inverter operation is accomplished with battery power only.

(7) Check inverter operation by placing volts-frequency selector switch on Flight Engineer/Second Officers electrical control panel, zone 215, in INVERTER position. Check for approximately 115V on adjacent AC VOLTS meter and for 390 to 410 Hz on adjacent FREQ meter. R

(8) Place STANDBY POWER INSTR & RADIO switch in OFF position, and verify that inverter ceases to operate.

(9) Close and lock access doors.

STATIC INVERTER RELAY - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
6-50-00	Interior Access Doors and Removable Panels - Description and Operation
24-32-03	Nickel-Cadmium Battery - Removal and Installation

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker BAT CHG (A15).

(2) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

WARNING: USE CAUTION IN MID ELECTRICAL SERVICE CENTER. VOLTAGES PRESENT CAN BE FATAL.

(3) Disconnect battery main connector (Ref. 24-32-03). Tag connector.

(4) Locate battery power equipment box on aft bulkhead of mid electrical service center and remove cover.

(5) Locate static inverter relay in box.

(6) Tag and remove all wires from relay.

(7) Remove mounting screws from relay and remove relay.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

(2) Place relay in proper position and install mounting screws.

(3) Remove tags and install and tighten all wires on relay.

(4) Install cover on battery power equipment box.

(5) Remove tag and connect battery main connector to battery.

(6) Close and secure access doors.

(7) Remove tag and close circuit breaker opened in Step 2A(1).

(8) On pilots eyebrow panel, zone 210, place STANDBY POWER - INSTR & RADIO switch in ON poition.

NOTE: Inverter operation is accomplished with battery power only.

(9) Check inverter relay operation by placing the volts-frequency selector switch on the Flight Engineer/Second Officers ELECTRICAL Control panel, zone 215, in the INVERTER position. Check for approximately 115V on adjacent AC VOLTS meter and for approximately
R 400 Hz on adjacent FREQ meter.

(10) Place STANDBY POWER - INSTR & RADIO switch in OFF position, and verify that inverter ceases to operate.

NICKEL-CADMIUM BATTERY - SERVICING

1. Equipment and Materials

Distilled water

CR Small nozzle Syringe, TWA Stk. No. 48-1134 or equivalent

CR Liquid level adjustment tool, TWA Stk. No. 48-2684 (Ref.
CR Illustrated Tool & Equipment Manual 24-31-08-0016)

C Vent cap wrench, TWA Stk. No. 47-2200

C Safety goggles

Nonmetallic brush

Clean cloth

2. Referenced Procedure

24-32-03 Nickel-Cadmium Battery - Removal and Installation

3. Servicing

A. General

Perform following battery maintenance with battery installed in aircraft in accordance with airline time limits and maintenance standards. Battery is located in mid electrical
C service center, zone 137. Battery must be fully charged (in
C pulse charge mode) prior to servicing.

B. Battery Servicing

WARNING: AVOID CONTACT WITH ELECTROLYTE (POTASSIUM HYDROXIDE) USED IN BATTERY. IF CONTACT OCCURS, REMOVE ELECTROLYTE FROM SKIN WITH A 3-PERCENT SOLUTION OF BORIC ACID, ACETIC ACID, OR VINEGAR. FLUSH AFFECTED AREA WITH WATER, AND TREAT AFFECTED AREA LIKE ANY OTHER CAUSTIC BURN

KEEP ALL METALLIC OBJECTS SUCH AS TOOLS, WIRE BRUSHES, WATCH BANDS, AND RINGS AWAY FROM UNCOVERED BATTERY CELLS.

C CAUTION: KEEP ALL EQUIPMENT AND MATERIALS USED FOR SERVICING LEAD-ACID BATTERIES AWAY FROM NICKEL-CADMIUM BATTERY, EQUIPMENT, AND MATERIALS. WEAR SAFETY GOGGLES WHEN SERVICING BATTERY.

C (1) Before checking battery electrolyte levels ensure that battery is fully charged by observing volt/amp meter on flight engineers panels. Full charge is indicated by ammeter pulses occurring at 5 minute, or greater, intervals.

C (2) Remove battery cover.

C (3) Clean vent caps and tops of cells, as necessary, using nonmetallic brush, and clean cloth.

C (4) Visually check cells for distortion. Check intercell connectors for looseness and signs of overheating. If above condition(s) exist, remove battery from aircraft and return to battery shop for maintenance (Ref. 24-32-03).

C CAUTION: KEEP CELL CAPS CLEAN AND ALL FOREIGN PARTICLES OUT OF THE CELLS WHILE CAPS ARE OFF.

C (5) Remove each cell cap with vent plug wrench TWA Stk. No. 47-2200.

CR (6) Insert liquid level adjustment tool, TWA Stk. No. 48-2684 (Ref. Illustrated Tool & Equipment Manual 24-31-08-0016) into each cell until collar at base of tube seats into cell vent hole.

C (7) Squeeze tool and release to draw any excess liquid out of cell.

C (8) If liquid level is not up to tip of tool, remove tool and add small amount of distilled water from plastic bottle TWA Stk. Nbr. 48-1134.

C (9) Repeat Steps (6), (7), and (8) until a small amount of liquid can be drawn from each cell.

C (10) If a cell requires an excessive amount of water as compared to other cells it should be replaced. This work should be done only in an authorized nickel-cadmium battery shop. This will require replacing the battery.

C (11) Replace and tighten each cell cap.

C (12) Install battery cover and secure holddown clamps.

NICKEL-CADMIUM BATTERY - REMOVAL AND INSTALLATION

1. Equipment and Materials

Hoist, PN PF51-011 PF Industries, or equivalent

Battery Hoist Support, PN 1302950-101, or equivalent

Battery Hoisting Adapter, PN 1302949-101, or equivalent

2. Referenced Procedure

	6-40-00	Exterior Access Doors and Removable Panels
R R	6-50-00	Interior Access Doors and Removable Panels - Description and Operation
	21-25-00	Electronic and Electrical Service Centers Cooling Systems
	24-00-00	Electrical Power - Maintenance Practices

3. Removal/Installation

WARNING: AVOID CONTACT WITH ELECTROLYTE USED IN NICKEL-CADMIUM BATTERY. WHEN SERVICING BATTERY OR HANDLING ELECTROLYTE, PROTECTIVE CLOTHING, FACE MASK, AND RUBBER GLOVES MUST BE WORN. IF ELECTROLYTE COMES IN CONTACT WITH SKIN, FLUSH AFFECTED AREA WITH A R 3-PERCENT BORIC ACID SOLUTION. AFTER AREA IS NEUTRALIZED, TREAT BURN LIKE ANY OTHER CAUSTIC BURN.

CAUTION: IF ELECTROLYTE IS SPILLED ON AIRCRAFT STRUCTURE, NEUTRALIZE IMMEDIATELY WITH A 3-PERCENT BORIC ACID SOLUTION. AFTER NEUTRALIZING, CLEAN AREA THOROUGHLY WITH WATER.

ENSURE THAT FUELING OPERATIONS ARE NOT IN PROGRESS. ENSURE THAT APU IS NOT IN OPERATION.

A. Removal

(1) Open and tag following switches:

(a) On Flight Engineer/Second Officers electrical control panel, zone 215: BATTERY

(b) On eyebrow panel, zone 210: STANDBY POWER-INSTR & RADIO

(c) On pilots overhead panel, zone 210: ESSENTIAL MASTER RADIO

(d) On Flight Engineer/Second Officers fuel system panel, zone 215: REFUEL POWER

(e) On refuel//defueling panel, zone 621: SYSTEM POWER

(f) On APU control panel, zone 215: MASTER POWER

(2) Open and tag following circuit breakers.

(a) On pilots overhead circuit breaker panel CB1, zone 210: ELECT CLOCK SYSTEM (B18)

(b) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215: BAT CHG (A15)

(3) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

(4) Attach hoist support to hard points in overhead structure.

(5) Attach portable hoist to hoist support, and attach battery removal adapter to hoist.

WARNING: DO NOT DISCONNECT BATTERY CONNECTOR UNLESS BATTERY SWITCH HAS BEEN PLACED IN OFF POSITION AND BATTERY CHARGER TRIP/SET CIRCUIT BREAKER IS OPEN.

(6) Turn knob on main battery connector J1 counterclockwise to release and disconnect battery connector.

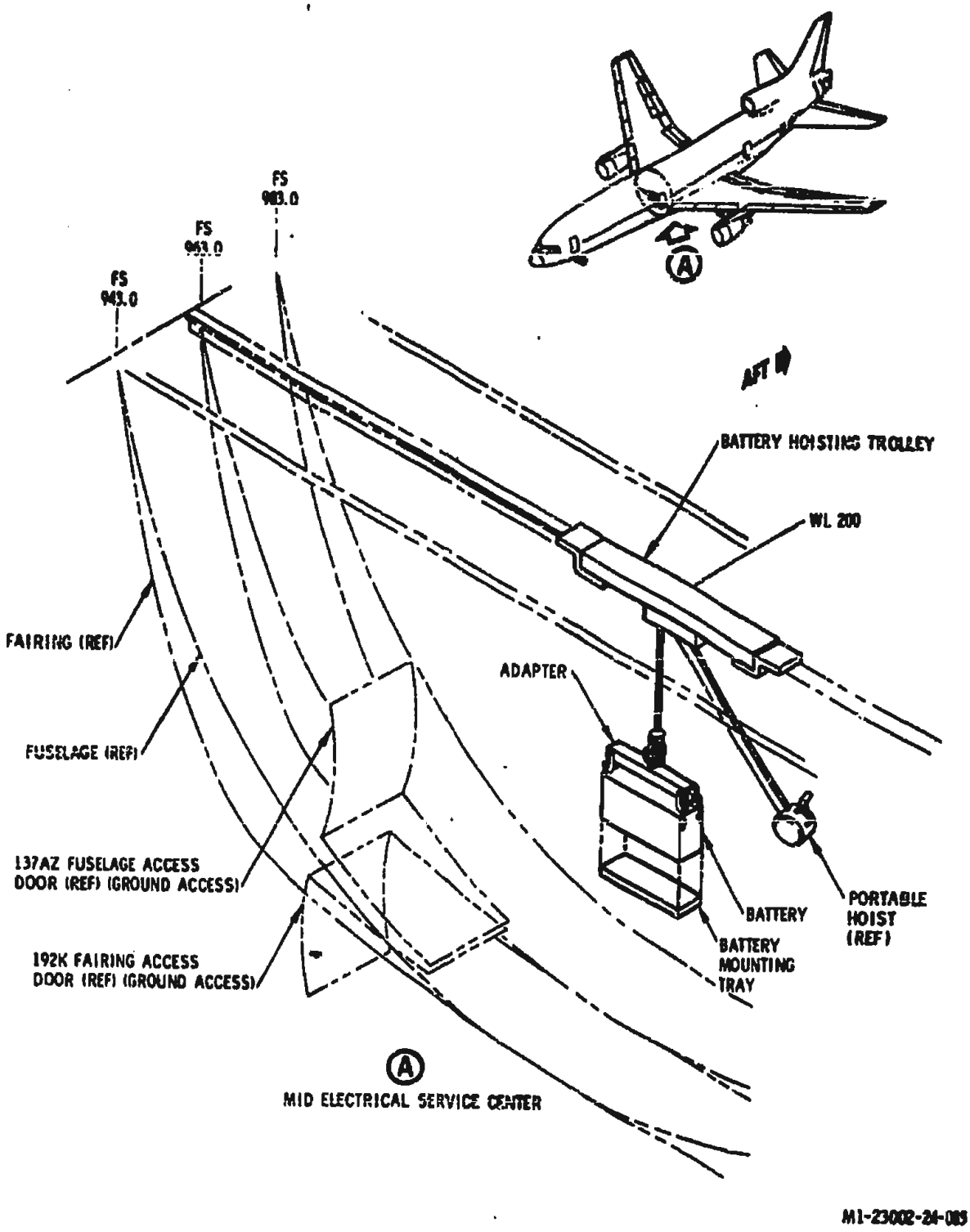
(7) Disconnect second electrical connector J2 from battery.

CAUTION: DUCT CLAMP MUST BE UNFASTENED BEFORE BATTERY REMOVAL OF AN AIR-COOLED BATTERY.

C R (8) Release cam-over battery holddown clamps and swing holddown bolts away from battery case.

C (9) Raise handle on each end of battery and attach hoisting adapter to battery handles.

C (10) Operate hoist to raise battery clear of mounting tray.



M1-23002-24-003

R
R Nickel-Cadmium Battery - Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

. C (11) Move hoist forward and to the right in overhead support until battery is directly above access doors.

C (12) Operate hoist to lower battery to service cart and remove hoisting adapter from battery. Remove hoisting adaptor from battery.

B. Installation

(1) Verify that switches opened in Step 3A(1) are open and tagged.

(2) Verify that circuit breakers opened in Step 3A(2) are opened and tagged.

(3) Attach hoisting adapter to battery with connectors facing outboard.

(4) Operate hoist, and lift battery into mid electrical service center high enough to clear battery tray.

(5) Move hoist aft and to the left until battery is directly above mounting tray.

CAUTION: VERIFY THAT INSULATOR IS IN GOOD CONDITION AND CORRECTLY INSTALLED IN MOUNTING TRAY BEFORE LOWERING BATTERY INTO PLACE .

(6) Lower battery into tray and remove hoisting adapter, hoist, and overhead support.

(7) Slide battery handles down.

(8) Move battery holddown bolts/bars into slots provided on battery cover and secure cam-over battery holddown latch (Ref. Fig. 402).

NOTE: If necessary, reposition screws in adjustable battery holddown bars to proper set of holes forbattery height (Ref. Fig. 403).

Cam-over holddown latch should be adjusted such that locating tab washer can just be positioned over holddown lug on battery cover (adjustment nut must not be torque tightened in any way). Over center cam of holddown latch provides required security for battery stowage. Torque figures silkscreen printed on cover of battery refer to terminal screws of battery cells.

C (9) Carefully align and install small electrical connector J2 to battery.

CAUTION: Ensure, when connecting to battery, that the five locating lugs are correctly aligned before inserting connector and tightening threaded coupling. Should undue force be required when locating connector or when screwing connector home, investigate and correct any interference before proceeding further.

C (10) Install main battery connector J1 and secure by turning C knob clockwise until tight. Safety knob to plug with C 20 gauge brass safety wire.

NOTE: Check and reset electronic clocks as necessary.

C (11) Remove tags from all switches opened in Step 3A(1) and place BATTERY switch in ON position.

C (12) Remove tags and close circuit breakers opened in Step 3A(2).

CAUTION: COOL-AIR DUCT MUST BE CONNECTED TO BATTERY AIR INLET WHEN INSTALLING AIR COOLED BATTERY AND MUST BE LEFT UNCAPPED WHEN INSTALLING NON-AIR COOLED BATTERY.

C (13) On aircraft with cooling fan installed, ensure that battery cooling fan operates when BAT CHG circuit breaker (CB3-A15) is closed. (Ref. 21-25-00 for details of battery cooling fan).

C (14) Place BUS VOLTS T/R AMPS selector switch on Flight Engineer/Second Officers electrical control panel in BAT position, and verify that adjacent dc voltmeter indicates approximately 26 volts.

WARNING: ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED BEFORE TURNING ON ELECTRICAL SYSTEM. HIGH VOLTAGES CAN BE FATAL.

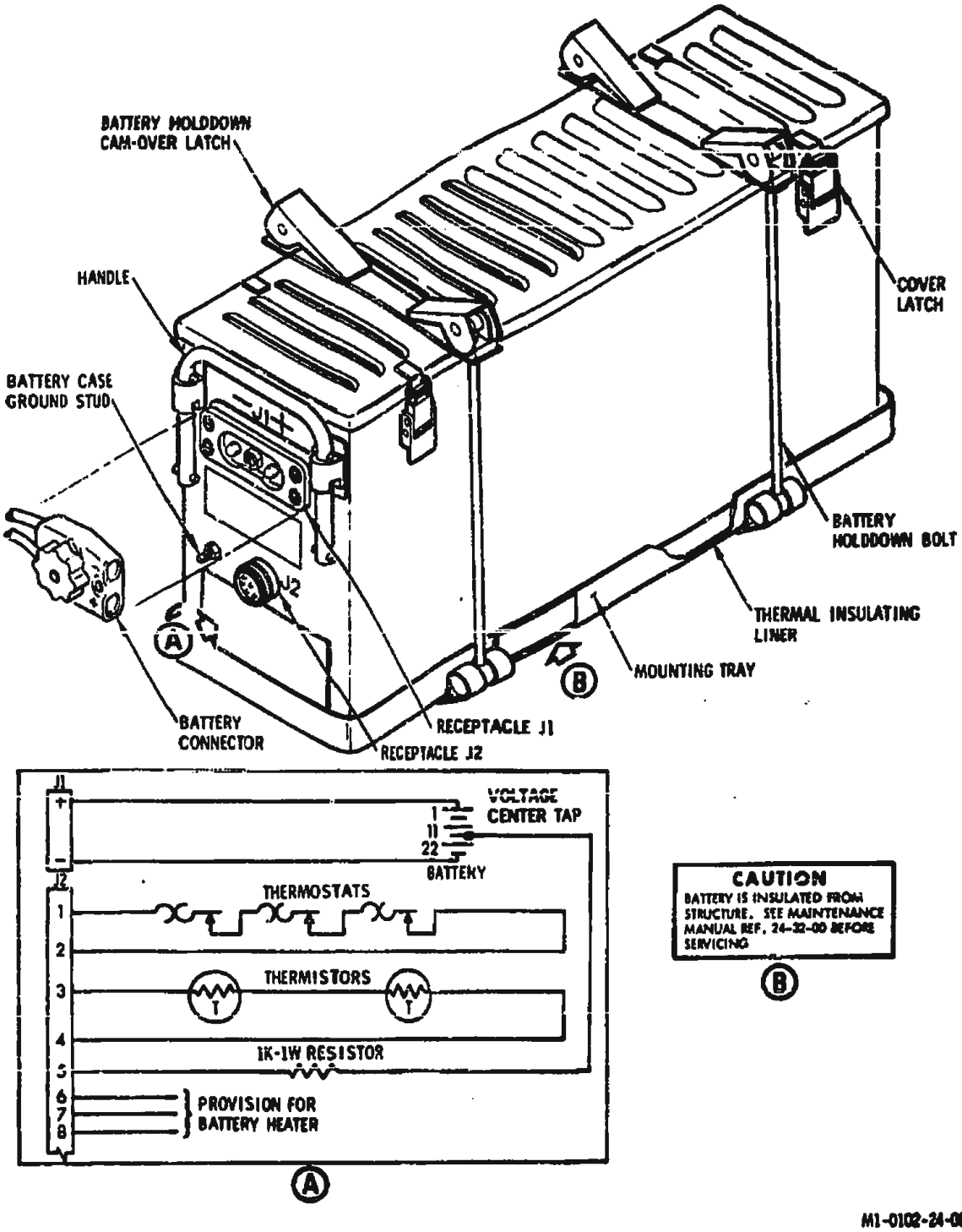
C (15) Turn on aircraft electrical system (Ref. 24-00-00).

C (16) Verify that ammeter on Flight Engineer/Second Officers electrical control panel indicates -40 amperes nominal if battery is not fully charged, or a pulsing indication if battery is fully charged.

C (17) Turn off aircraft electrical system (Ref. 24-00-00).

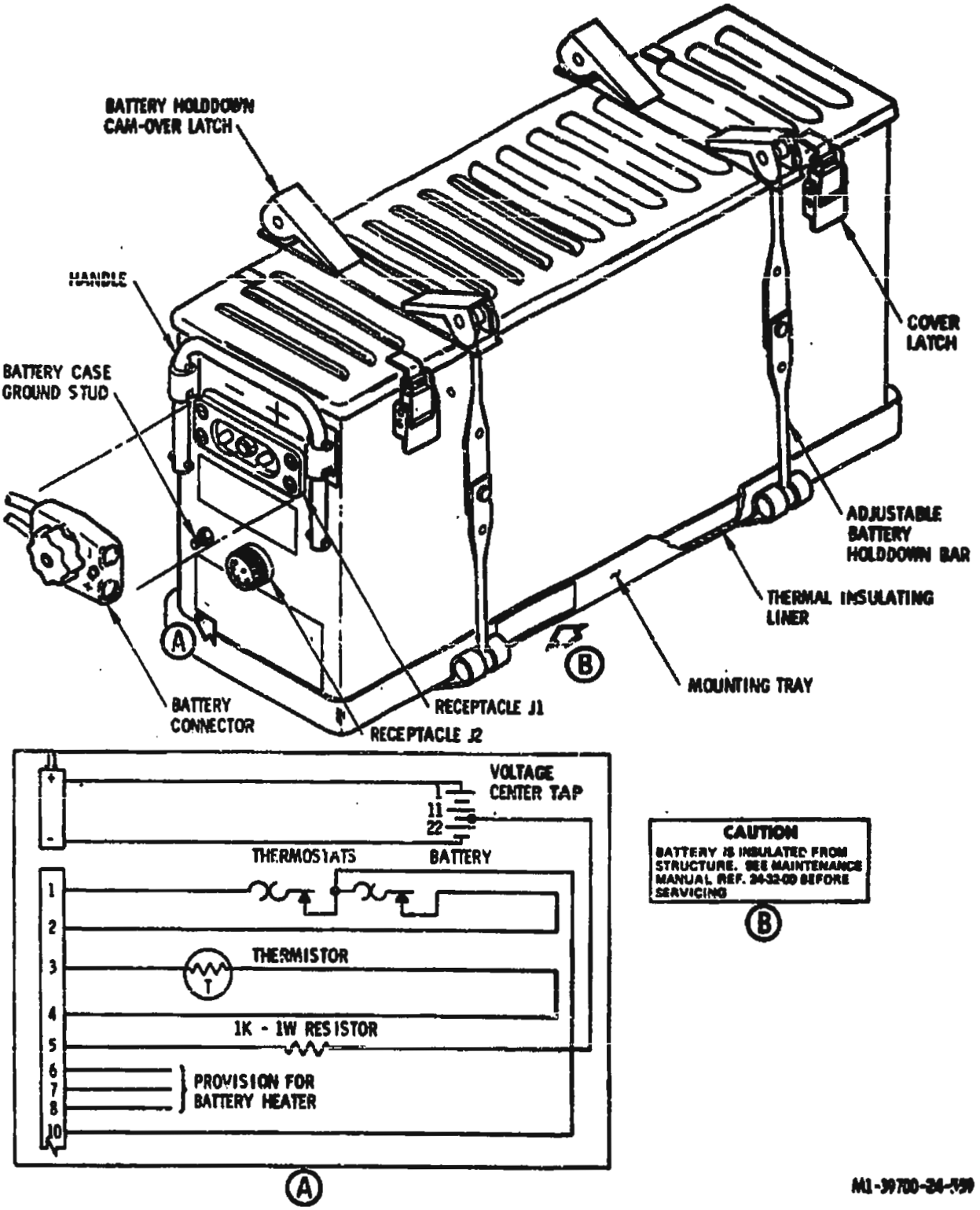
C (18) Place BATTERY switch in OFF position.

C (19) Close and secure access doors.



M1-0102-24-002

Nickel-Cadmium Battery Installation - Fixed Height
Figure 402



Nickel-Cadmium Battery Installation - Adjustable Height
Figure 403

NICKEL-CADMIUM BATTERY - INSPECTION AND CHECK

1. General

The battery is located in the MESC. Access to the battery is through ground access doors or through the galley wall door (Ref. 6-40-00, 6-50-00).

The battery must be serviced at regular intervals. Servicing of the installed battery is limited to checking the electrolyte level and cleaning. If fluid level is low, replenish with distilled water only. All other battery servicing and testing must be performed in the battery shop; refer to Overhaul Manual (Gulton Industries, Inc. 24-32-03).

2. Equipment and Materials

Distilled water

C Small nozzle syringe, TWA Stk. No. 48-1134 or equivalent

CR Liquid level adjustment tool, TWA Stk. No. 48-2684 (Ref.
CR Illustrated Tool & Equipment Manual 24-31-08-0016).

C Vent cap wrench, TWA Stk. No. 47-2200

C Safety goggles

Container of clean water

Nonmetallic Brush

Clean cloth

3. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels
6-50-00	Interior Access Doors and Removable Panels
21-25-00	Electronic and Electrical Service Centers Exhaust Systems - Description and Operation
24-00-00	Electrical Power - Maintenance Practices
24-32-03	Nickel-Cadmium Battery - Removal and Installation

WARNING: AVOID CONTACT WITH ELECTROLYTE (POTASSIUM HYDROXIDE) USED IN BATTERY. REMOVE ELECTROLYTE FROM SKIN WITH A THREE PERCENT SOLUTION OF BORIC ACID, ACETIC ACID OR VINEGAR. FLUSH AFFECTED AREA WITH LARGE AMOUNT OF WATER. TREAT LIKE ANY OTHER CAUSTIC BURN.

KEEP ALL METALLIC OBJECTS SUCH AS TOOLS, WIRE BRUSHES, WATCH BANDS, AND RINGS AWAY FROM UNCOVERED BATTERY CELLS.

CAUTION: KEEP ALL EQUIPMENT AND MATERIALS USED FOR SERVICING LEAD-ACID BATTERIES AWAY FROM NICKEL-CADMIUM BATTERY.
C WEAR SAFETY GOGGLES WHEN SERVICING BATTERY.

4. Inspection/Check

A. Nickel-Cadmium Battery

(1) Before checking battery electrolyte levels, ensure that battery is in pulse charging mode by verifying that DC AMPS meter on Flight Engineer/Second Officers ELECTRICAL panel, zone 215, is pulsating.

(2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker BAT CHG (A15).

(3) Remove battery cover.

(4) Visually inspect battery components and wiring for cracks, corrosion, and signs of arcing.

(5) Check cell assemblies, gasket, cover strips and holddown pads for distortion and deterioration.

(6) Using nonmetallic brush, clean cloth and clean water, clean vent caps and top of cells as necessary.

(7) Check electrolyte level.

C (a) Preferred Method

CR 1) Remove each cell cap and insert the tube end
CR of liquid level adjustment tool, TWA Stk. No.
CR 48-2684 (Ref. Illustrated Tool & Equipment Manual
CR 24-31-08-0016) into each cell filler hole until
C collar at base of tube seats into filler cap
C receptacle.

C 2) Squeeze tool and release to draw any excess
C liquid out of cell.

C 3) If liquid level is not up to tip of tube
C remove tool and add small amount of distilled or
C demineralized water, using TWA Stk. No. 48-1134
C plastic bottle or equivalent.

C 4) Repeat steps 1), 2) and 3) until a slight
C amount of liquid can be drawn from each cell.

C (b) Alternate Method

C 1) Fill as indicated by glow indicator (Ref. Fig. 601). If a cell requires an excessive amount of water as compared to other cells, the cell may be defective. Remove battery and return to battery shop for necessary maintenance (Ref. 24-32-03).

NOTE: Before magic eye can glow, ambient area must be illuminated. For best results, direct flashlight beam down filler well.

(8) Reinstall cell cap.

(9) Clean spilled electrolyte from top of battery as outlined in Step (6)

(10) Check battery thermistor resistance by disconnecting
R battery connector J1 and measuring resistance between pins 3 and 4.

NOTE: Thermistor resistance is dependent on battery temperature. Battery temperatures and corresponding thermistor values are listed in Table 601. If thermistor resistance is abnormal, replace battery.

Battery Thermistor Resistance Check
Table 601

Battery Temperature	Thermistor Resistance
50 Deg. F.	4000 OHMS
55 Deg. F.	3500 OHMS
60 Deg. F.	3000 OHMS
65 Deg. F.	2600 OHMS
70 Deg. F.	2300 OHMS
75 Deg. F.	2000 OHMS

Battery Thermistor Resistance Check (Cont)
Table 601

Battery Temperature	Thermistor Resistance
80 Deg. F.	1800 OHMS
85 Deg. F.	1600 OHMS
90 Deg. F.	1400 OHMS
95 Deg. F.	1300 OHMS
100 Deg. F.	1200 OHMS

(11) Reconnect battery connector J2.

(12) Install battery cover and secure holddown clamps.

R CAUTION: ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED
R BEFORE TURNING ON ELECTRICAL POWER. HIGH VOLTAGES
R CAN BE FATAL.

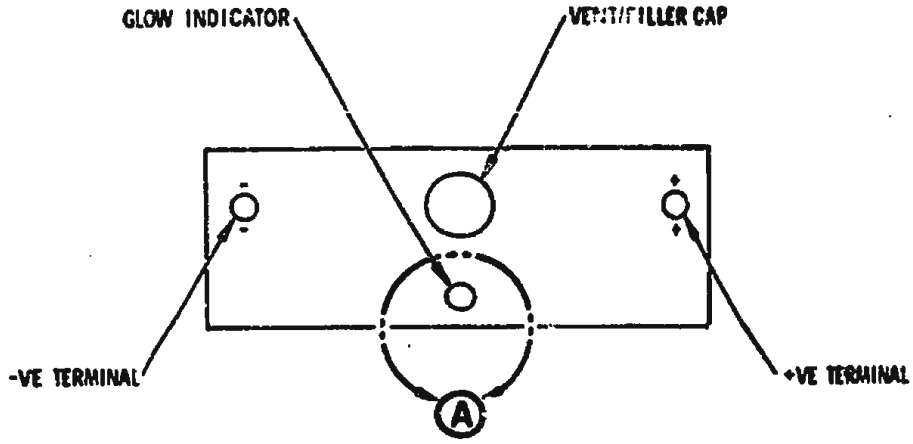
R (13) Turn on electrical power (Ref. 24-00-00).

R (14) Close circuit breaker opened in Step (2) (circuit breaker panel CB3). On aircraft with battery cooling fan installed ensure that battery cooling fan operates when BAT CHG circuit breaker (CB3-A15) is closed. (Ref. 21-25-00 for details of battery cooling fan).

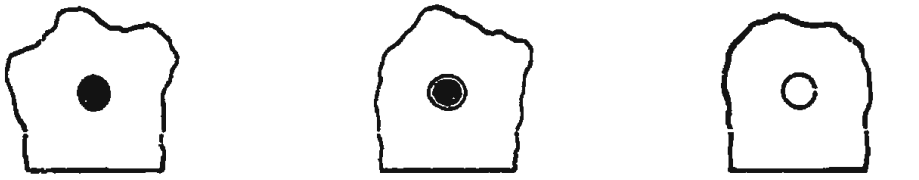
R (15) Place BUS VOLTS T/R AMPS selector switch on Flight Engineer/Second Officers electrical control panel in BAT position, and verify that adjacent dc voltmeter indicates approximately 26 volts.

(16) Verify that ammeter on Flight Engineer/Second Officers electrical control panel indicates -40 amperes nominal if battery is not fully charged, or a pulsing indication if battery is fully charged.

(17) Turn off electrical power (Ref. 24-00-00).



VIEW ON TOP OF CELL



1 CONDITIONS

A DO NOT ADD WATER

B SMALL QUANTITIES OF WATER SHOULD BE ADDED TO CELLS UNTIL THEY CHANGE TO CONDITION A

C WATER MUST BE ADDED TO CELLS IN THIS CONDITION BUT NOT IN QUANTITIES EXCEEDING 5CC (OR 5 ml) AT A TIME. WHEN INDICATOR CHANGES TO CONDITION B DECREASE AMOUNTS OF WATER ADDED TO AVOID OVERFILLING AND CEASE ADDING WATER WHEN CONDITION A IS REACHED

M1-0105-24-550

Battery Cell Indicator
Figure 601

BATTERY CHARGER - REMOVAL AND INSTALLATION

1. Referenced Procedure

R R	6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
R R	6-50-00	Interior Access Doors and Removable Panels - Description and Operation
	20-23-02	Rack Mounted ARINC Box Lever Latch - Maintenance Practices
	24-00-00	Electrical Power - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker BAT CHG (A15).

R R (2) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

WARNING: HIGH VOLTAGES IN THIS AREA CAN BE FATAL.

(3) Locate charger on left equipment rack. Release lever latches on handles and pull charger (weighs 20.4 pounds) from rack and mating receptacle.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

(2) Place charger in space on left equipment rack and slide outboard to mate with electrical connectors.

(3) Attach lever latches (in handles) to secure charger (Ref. 20-23-02).

(4) Remove tag and close circuit breaker opened in Step 2A(1).

R WARNING: BEFORE TURNING ON ELECTRICAL SYSTEM, ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED. HIGH VOLTAGES CAN BE FATAL.

R (5) Turn on aircraft electrical system (Ref. 24-00-00).

(6) Place BUS VOLTS T/R AMPS selector switch on Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, in BAT position, and verify normal charger operation on adjacent dc voltmeter and dc ammeter.

NOTE: Battery charger output is dependent on condition of battery. If DC VOLTS meter indicates less than 30V, DC AMPS meter will indicate negative 40 amp. If the DC VOLTS meter indicates more than 30V, the DC AMPS meter will indicate a frequent negative 40-amp pulse which drops back to zero rapidly. The above conditions are for normal ambient temperature conditions. Meter indications will vary with battery temperature.

R (7) Turn off aircraft electrical power system (Ref. 24-00-00).

(8) Close and secure access doors.

BATTERY CHARGER RELAY - REMOVAL AND INSTALLATION

1. Referenced Procedure

6-40-00	Exterior Access Doors and Removable Panels
6-50-00	Interior Access Doors and Removable Panels
24-32-03	Nickel-Cadmium Battery - Removal and Installation
24-41-00	External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

R (1) On aircraft 001-031, on Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker BAT CHG (A15).

R (1) On aircraft 032-999, on Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breakers BAT CHG (A15) and APU T/R PWR (B11).

(2) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

WARNING: USE CAUTION IN MID ELECTRICAL SERVICE CENTER. VOLTAGES PRESENT CAN BE FATAL.

(3) Disconnect battery main connector J1 (Ref. 24-32-03). Tag connector.

(4) Locate battery power equipment box on aft bulkhead of mid electrical service center and remove cover.

(5) Locate battery charger relay in box.

(6) Tag and remove all wires from relay.

(7) Remove mounting screws from relay and remove relay.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Place relay in proper position and install mounting screws.

(3) Remove tags and install and tighten all wires on relay.

(4) Install cover on battery power equipment box.

(5) Remove tag and connect battery main connector to battery.

(6) Close and secure access doors.

(7) Remove tag and close circuit breakers opened in Step 2A(1).

R (8) Turn on aircraft electrical system (Ref. 24-41-00).

(9) On Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, place BUS VOLTS - T/R AMP selector switch in BAT position and verify a pulsing or steady charge indication on adjacent DC AMPS meter.

R (10) Turn off aircraft electrical system (Ref. 24-41-00).

ENGINE START BUS RELAY - REMOVAL AND INSTALLATION

1. Referenced Procedures

21-82-04	SLAT MONITOR PANEL - Removal and Installation
24-00-00	Electrical Power - Maintenance Practices
26-11-98	WHEEL WELL FIRE TEST PANEL - Removal and Installation
32-45-01	BRAKE TEMPERATURE MONITOR PANEL - Removal and Installation
36-00-01	INTEGRATED PNEUMATIC SYSTEM CONTROL PANEL - Removal and Installation
36-22-99	NACELLE/PYLON OVHT DET TEST PANEL - Removal and Installation

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag the following circuit breakers:

STANDBY DC - CONT (B12) and ENG START PWR (B15)

ELEC BUS CONT - ENG START BUS IND (K12) AND DC STBY IND (K13)

HYD PUMP & FIREWALL SHUTOFF VALVE CONT - SYS D (L18)

On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker ENG START PWR (F10).

(2) Remove Flight Engineer/Second Officers panels as shown in Figure 401 (Ref. 21-82-04, 26-11-98, 32-45-01, 36-22-99).

(3) Slide out Flight Engineer/Second Officers Integrated pneumatic system panel (Ref. 36-00-01).

NOTE: Do not remove or disonnect Integrated pneumatic system panel.

R (4) Remove trim panels.

R (5) Remove relay from above and behind BRAKE TEMP monitor
R panel.

R (a) Insert left hand with tri-wing screw driver
R through opening for integrated pneumatic system
R panel.

R (b) Insert right hand above Flight Engineer/Second
R Officers console to guide tri-wing screw driver.

R (6) Cut harness ties as necessary to gain slack and pull
R through front of Flight Engineer/Second Officers
R console.

R (7) Disconnect and tag wires.

R B. Installation

R (1) Verify that circuit breakers opened in Step 2A(1) are
R opened and tagged.

R (2) Connect relay wires and remove tags.

R (3) Insert relay and fasten mounting hardware.

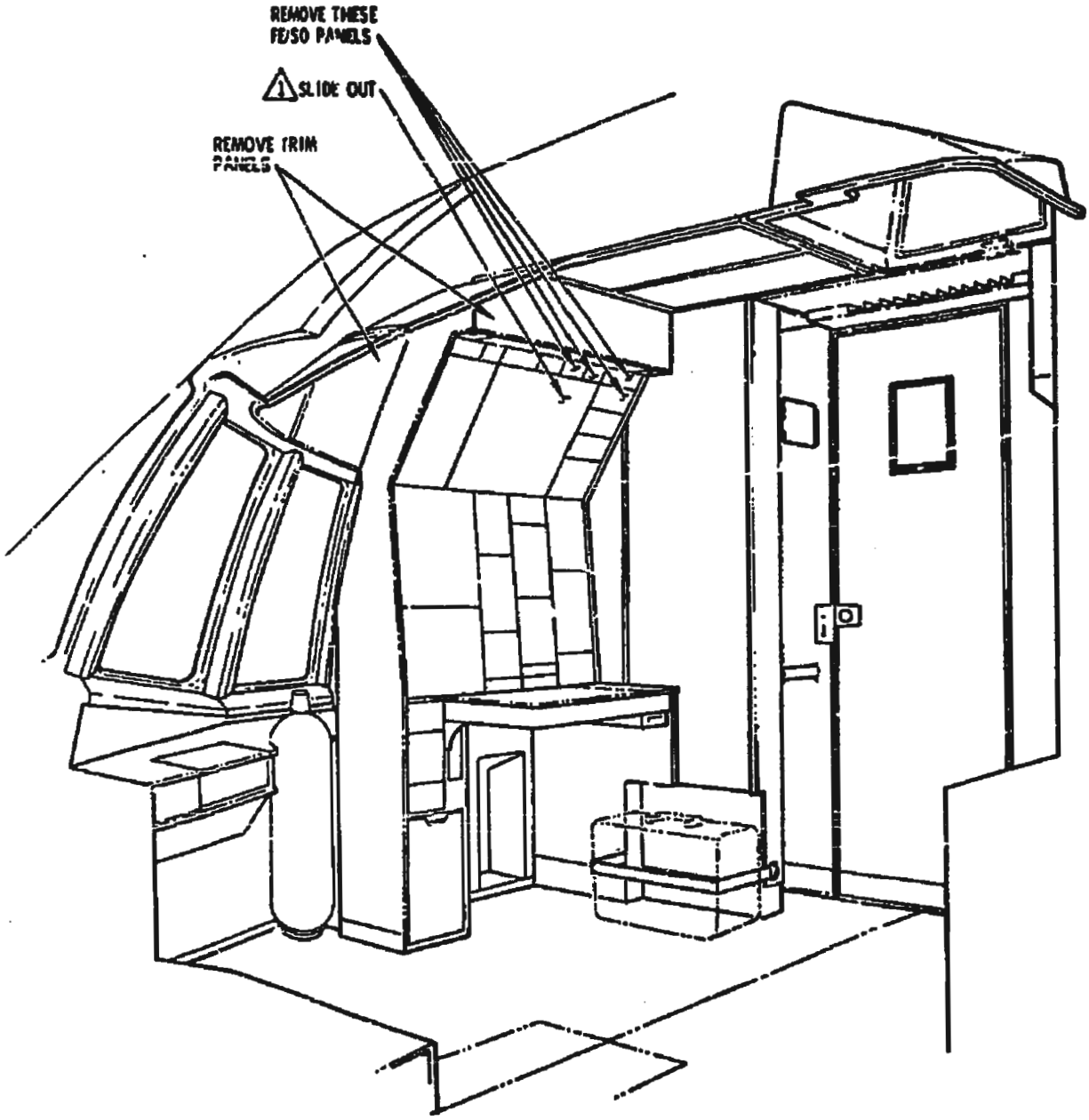
R NOTE: Replacement of tri-wing screws with hex head
R bolts will facilitate future removal and
R installation.

R (4) Tie harness and re-install panels removed in Steps
R 2A(2) and (3) (Ref. 21-82-04, 26-11-98, 32-45-01,
R 36-00-01, 36-22-99).

R (5) Remove tags and close circuit breakers opened in Step
R 2A(1).

R (6) To test relay, verify that STANDBY POWER INSTR & RADIO
R switch located on the eyebrow panel, zone 210, is in
R the ON position. Verify that STBY PWR flowbar, located
R on the Flight Engineer/Second Officers ELECTRICAL panel
R is on.

R (7) Turn off electrical power (Ref. 24-00-00).



M1-0100-24-538

R Flight Compartment Engine Start Bus Relay Access Panel Removal
R Figure 401

BATTERY BUS CURRENT LEVEL TIME DELAY RELAY - REMOVAL AND INSTALLATION

1. Reference Procedures

24-00-00	Electrical Power - Maintenance Practices
24-32-04	Battery Charger - Removal and Installation
24-41-00	External Power 1 Ground Service System - Maintenance Practices
24-32-03	Nickel Cadmium Battery - Removal and Installation

2. Removal/Installation

A. Removal

WARNING: REMOVE ELECTRICAL POWER FROM AIRCRAFT BEFORE WORKING ON FLIGHT STATION COMPONENTS AND WIRING (REF. MM 24-00-00).

(1) In MESC disconnect Battery Connector J1 from battery (Ref. MM 24-32-03).

(2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker BAT CHG (A15).

WARNING: USE CAUTION IN FLIGHT STATION COMPONENTS AND WIRING AREAS. ACCIDENTAL POWER APPLICATION COULD BE FATAL DUE TO HIGH VOLTAGES.

(3) Remove panel retaining screws and lower the two panels of the Flight Engineer/Second Officers overhead circuit breaker panel CB2.

(4) Locate time delay relay.

(5) Remove relay from relay socket, held on by mounting nuts.

B. Installation

(1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

(2) Place time delay relay in proper position and install mounting nuts.

(3) Close and secure access panels.

(4) Connect Battery Connector J1 removed in Step 2A(1).

(5) Return electrical power to aircraft (Ref. MM 24-00-00).

(6) Remove tag and close circuit breaker opened in Step 2A(1).

(7) To test relay, operate the BATTERY CHARGER MODE SWITCH to the STBY position. Operate the BATTERY switch, and the STBY POWER INSTR & RADIO switch located on the eyebrow panel, zone 210, to the ON position. Verify that STBY POWER flowbar, on the Flight Engineer/Second Officers electrical panel is ON, and the PWR ON light illuminates after 5 seconds.

(6) Turn off electrical power (Ref. 24-00-00).

BATTERY BUS DC CURRENT LEVEL DETECTOR - REMOVAL AND INSTALLATION

1. Reference Procedures

24-00-00	Electrical Power - Maintenance Practices
24-32-03	Nickel Cadmium Battery - Removal and Installation
24-32-04	Battery Charger - Removal and Installation
24-41-00	External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

WARNING: REMOVE ELECTRICAL POWER FROM AIRCRAFT BEFORE WORKING ON FLIGHT STATION COMPONENTS AND WIRING (REF. MM 24-00-00).

(1) In MESC disconnect Battery Connector J1 from battery (Ref. MM 24-32-03)

(2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breakers, BAT CHG (A15), and DC STBY IND (K13).

WARNING: USE CAUTION IN FLIGHT STATION COMPONENTS AND WIRING AREAS. ACCIDENTAL POWER APPLICATION COULD BE FATAL DUE TO HIGH VOLTAGES.

(3) Remove trim panel above the upper panel on the Flight Engineer/Second Officers console.

R (4) Locate CURRENT LEVEL DETECTOR (Ref. Fig. 401), disconnect and tag wiring.

(5) Remove mounting hardware, and remove detector.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

R CAUTION: DC CURRENT LEVEL DETECTOR IS SENSITIVE TO
R DIRECTION OF CURRENT FLOW. VERIFY THAT WIRE
R 2562-1BA18 FROM CIRCUIT BREAKER 2561-CB1 IS ROUTED
R INBOARD TO OUTBOARD.

(2) Connect detector wiring, and remove tags.

(3) Place CURRENT LEVEL DETECTOR in proper position and install mounting hardware.

(4) Close and secure trim panel.

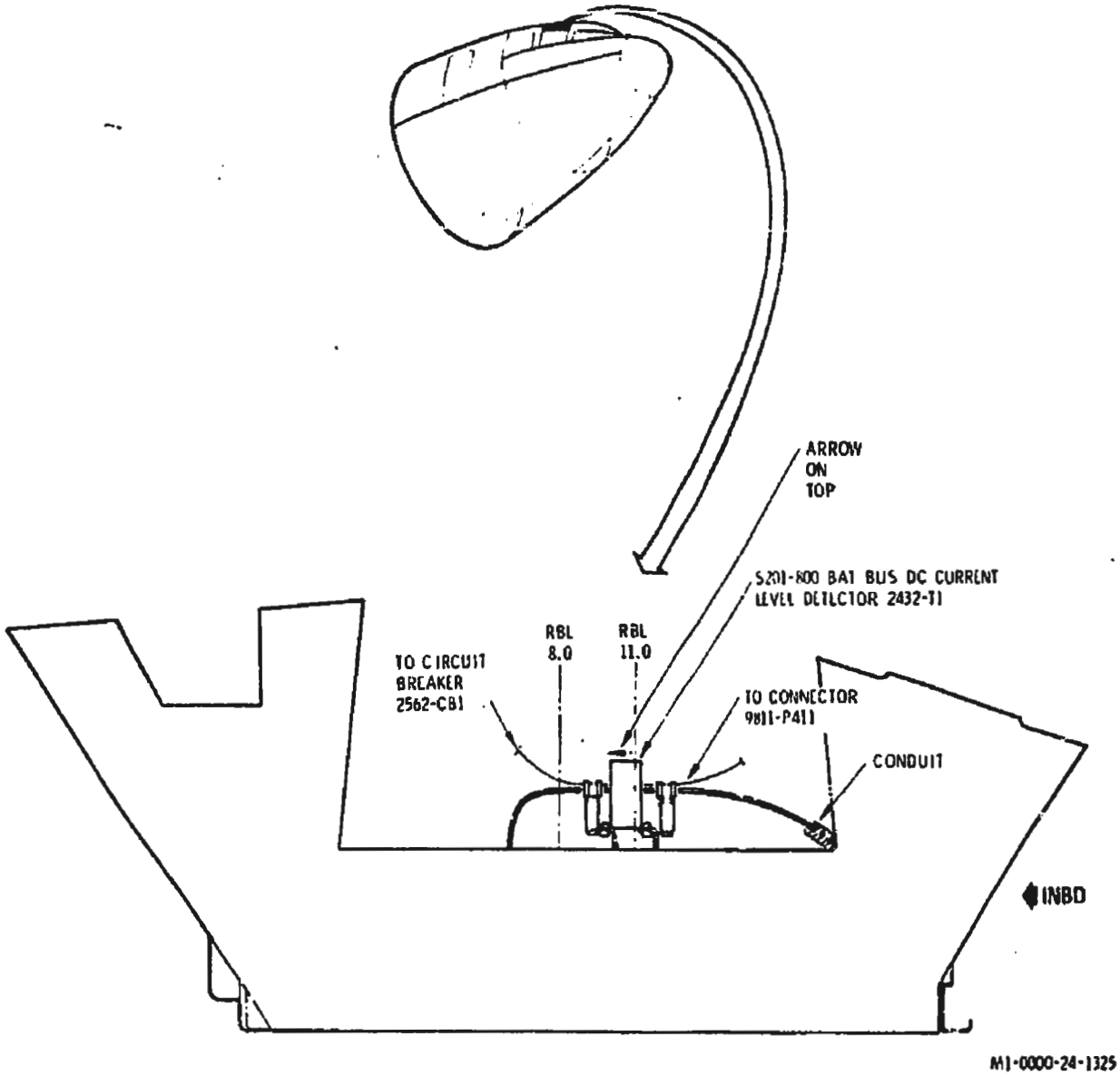
(5) In MESC, connect battery connector J1 disconnected in Step 2A(1) (Ref. MM 24-32-03)

(6) Restore electrical power on aircraft (Ref. MM 24-00-00)

(7) Remove tags, and close circuit breakers opened in Step 2A(1).

(8) To test current level detector operate the BATTERY CHARGER MODE switch to the STBY position. Operate the BATTERY switch, and the STBY POWER INSTR & RADIO switch to ON. The flowbar light should illuminate immediately, and after a 5 second time delay the ON light should illuminate.

(7) Turn off electrical power (Ref. 24-00-00).



R Battery Bus Extension DC Current Level Detector
R Figure 401

APU POWER SYSTEM- DESCRIPTION AND OPERATION

1. General

The APU power system selects proper power sources and distributes 28V dc to the APU power panel for control and operation of the APU.

The system consists of:

A remote controlled circuit breaker (RCCB) and a power transfer relay located in battery power distribution box in the mid electrical service center, zone 137

Two push-pull, trip-free, single-phase circuit breakers located on the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215

One section of the MASTER POWER switch on the APU CONTROL panel, zone 215

An APU battery bus in the aft electronic equipment area, zone 164

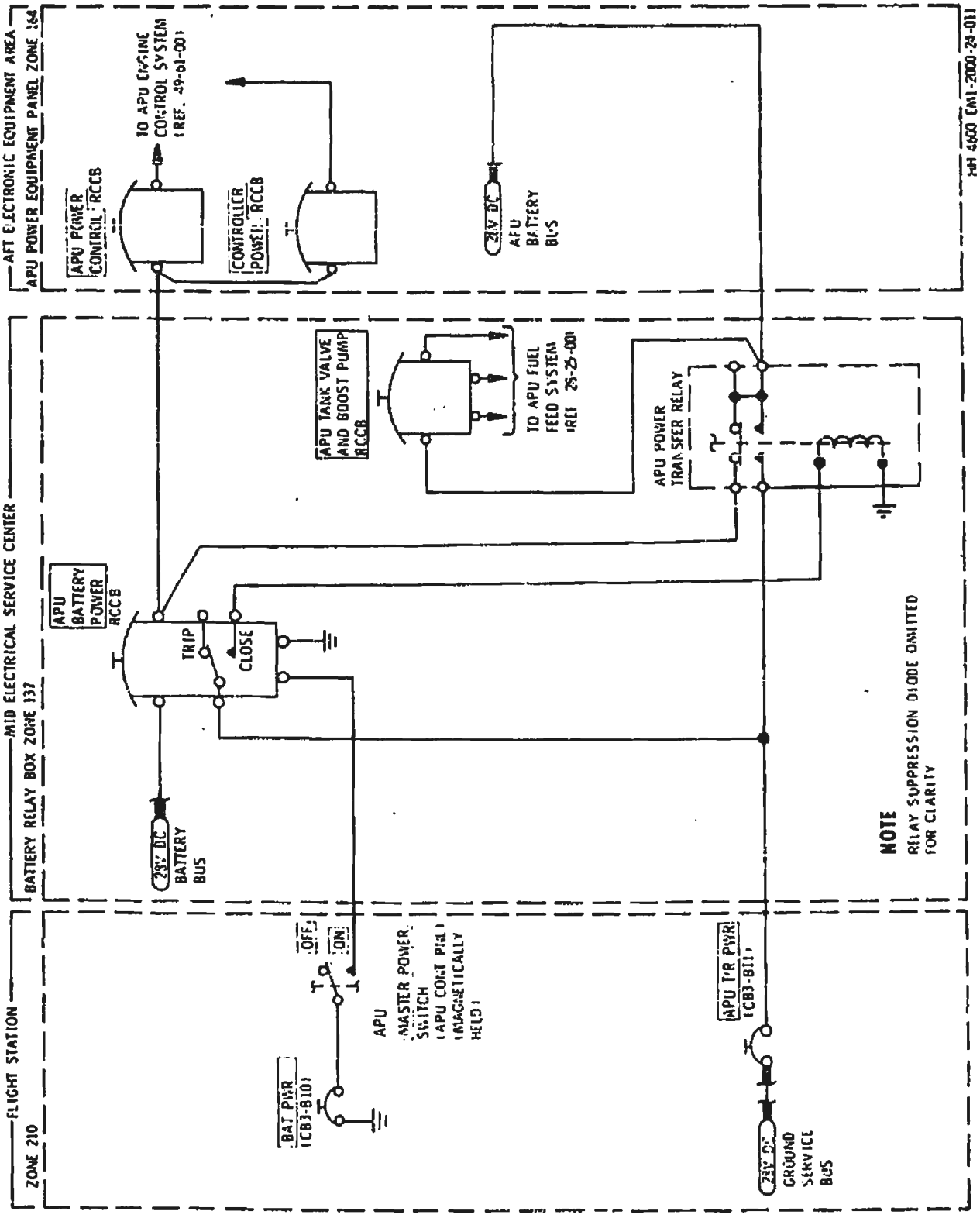
The system is controlled by the MASTER POWER switch. The APU battery bus is energized from the battery bus or from the dc ground service bus, depending on operating conditions.

2. Operation

The APU power system (Ref. Fig. 1) operates as follows: With the APU POWER - APU BAT PWR and APU TR POWER circuit breakers closed and the MASTER POWER switch ON, the APU BATTERY POWER RCCB is closed. If the dc ground service bus is energized, closed contacts within the RCCB complete a circuit to energize the APU power transfer relay. The energized relay causes the APU battery bus to be energized from the dc ground service bus. If the dc ground service bus is deenergized, the relay remains deenergized and the APU battery bus is energized from the battery bus through the APU BATTERY POWER RCCB. The RCCB connects battery power to the APU POWER CONTROL and APU CONTROLLER POWER RCCB (Ref. 49-61-00).

3. APU Power Transfer Relay

A. Description and Operation


AFT ELECTRONIC EQUIPMENT AREA
APU POWER EQUIPMENT PANEL ZONE 184
HH 4600 EM1-2000-24-011
TO APU ENGINE CONTROL SYSTEM (REF. 49-01-00)
APU POWER CONTROL RCCB
CONTROLLER POWER RCCB
28V DC APU BATTERY BUS
APU TANK VALVE AND BOOST PUMP RCCB
TO APU FUEL FEED SYSTEM (REF 28-25-00)
APU POWER TRANSFER RELAY
MID ELECTRICAL SERVICE CENTER
BATTERY RELAY BOX ZONE 137
APU BATTERY POWER RCCB
TRIP
CLOSE
28V DC BATTERY BUS
NOTE
RELAY SUPPRESSION DIODE OMITTED FOR CLARITY
FLIGHT STATION
ZONE 210
OFF
ON
APU MASTER POWER SWITCH (APU CONT PNL) (MAGNETICALLY HELD)
BAT PWR (CB3-B10)
APU T/R PWR (CB3-B11)
28V DC GROUND SERVICE BUS

R
R APU Power System Functional Diagram
Figure 1

R On aircraft 001-031 without SB24-080, the APU power transfer relay is a 50-ampere, single-pole, double-throw (SPDT) unit. In addition to the main 50-ampere contacts, two sets of SPDT auxiliary contacts are incorporated. The main contacts are used to transfer the APU battery bus from the battery bus to the dc ground service bus whenever the relay is energized. The auxiliary contacts are not used.

R On aircraft 001-031 with SB24-080 and 032-999, the APU power transfer relay is a 50-ampere, single-pole, single-throw (SPST) unit. In addition to the main 50-ampere contacts, two sets of SPST auxiliary contacts are incorporated. The main contacts are used to transfer the APU battery bus from the battery bus to the dc ground service bus whenever the relay is energized. The auxiliary contacts are not used.

EXTERNAL POWER/GROUND SERVICE SYSTEM - DESCRIPTION AND OPERATION

1. General

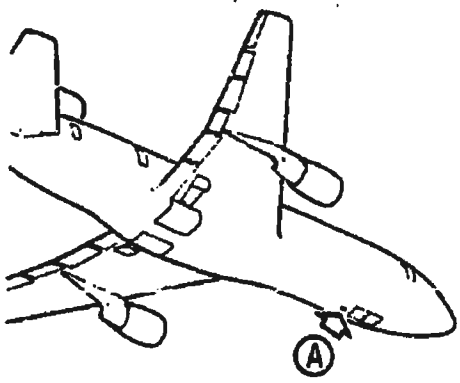
The external power/ground service system provides a means of energizing all or part of the aircraft electrical system from an external power source. Normally, reference is made to the external power system when energizing the entire bus system. Reference is made to the ground service system when energizing part of the system. The ground service system may also be energized by the APU generator.

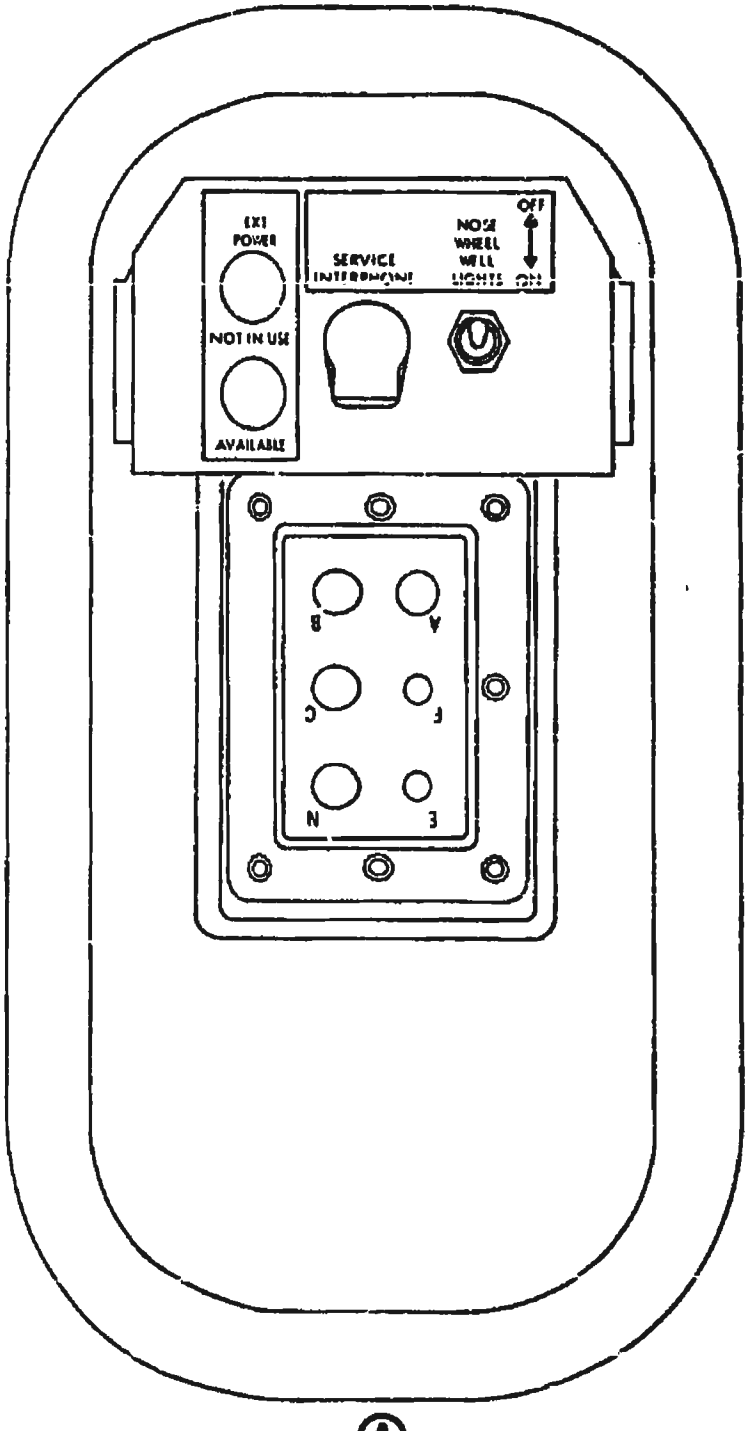
For ground servicing operations, an external ac power source, capable of providing 90 kVA, 115/200V, 400-Hz, three-phase power is used. The source is connected through the external power receptacle and relay to energize the ac bus system. The ac buses energize the transformer-rectifiers (TR) for conversion to dc power. The entire electrical system, or only those buses needed for ground servicing or towing operations, may be energized as necessary.

The system consists of a polarized six-pin receptacle (Ref. Fig. 1), an external power relay (EPR), a bus protection panel (BPP), and four control switches. The system also includes an AVAIL/ON light, an AVAILABLE light, a NOT IN USE light, and a set of
R auxiliary contacts in each of the three bus tie breakers (BTB) and the four generator breakers (GB). Four additional relays are used to control the buses not used during ground service operation.

The EXT PWR control switch and the AVAIL/ON light are located on the Flight Engineer/Second Officers electrical control panel, zone 215. One GND SERVICE control switch is located on the electrical control panel, and two control switchlights (GND SVCE ON and GND SVCE OFF) are located on the attendants forward control panel, zone 221. The flight station GND SERVICE switch permits selection of either the external power source or the APU generator for ground service operations, while the attendants switchlights permit use of the external source only.

The receptacle, the EXT POWER - AVAILABLE light, and the EXT POWER - NOT IN USE light are located in the receptacle area on the lower fuselage to the right of center just aft of the nosewheel well, FS 458. The receptacle is covered with a hinged door, which prevents entrance of foreign material and streamlines the fuselage surface. The EPR, BPP, GB, and BTB are located in the mid electrical service center, zone 137.





External Power Receptacle
Figure 1

2. Operation

If all buses are to be energized, an external power source capable of supplying 90 kVA (continuous) without overloading must be used. An external power source which uses the dc voltage (supplied by the BPP) on pin F of the external power receptacle to control the output, must be used to obtain the additional external power feeder protection provided by the aircraft system. If all buses are not to be energized, a power source of corresponding lower capacity can be used. The

R When the power source is connected and energized (Ref. Fig. 2),
R the EXT POWER - NOT IN USE and AVAILABLE lights, located next to
R the receptacle, come on. The AVAILABLE light is energized
R directly from Phase A of the external power source through a
R voltage-dropping resistor. The EXT POWER - NOT IN USE light
R receives power from Phase B of external power through contacts
R of the deenergized EPR and a voltage-dropping resistor.

Three-phase external power is connected to the BPP, where it is sensed for voltage, frequency, and phase rotation. If conditions are correct, a 28-volt signal is available from the BPP transformer rectifier (TR). This signal is routed through switching circuits to light the AVAIL portion of the AVAIL/ON light on the electrical control panel. This signal also energizes the common pole of the EXT PWR switch. A volts-frequency selector switch is located on the electrical control panel. When the selector switch is placed in the EXT POWER position, external power status is indicated on adjacent volt and frequency meters.

When the EXT PWR switch is placed in the ON position, the following events occur to energize the ac tie bus:

A. The 28-volt signal from the BPP TR is routed through the closed (momentary) contacts of the switch, through an OR gate in the BPP, and to the EPR control circuitry.

B. The EPR control circuitry provides power to energize the EPR, and through contacts of the energized relay, to hold the EXT PWR switch in the ON position. The circuitry also lights the ON portion of the AVAIL/ON light on the electrical control panel, and causes the NOT IN USE light at the receptacle to go off. The EPR is energized whenever the following conditions are met:

(1) No external power faults exist (voltage and frequency correct)

(2) Phase sequence of external power is correct

(3) The external power interlock circuit through the GB and/or the BTB is complete.

The actions that take place at this time depend on the existing conditions. If no aircraft generators are operating, all the BTB will be in the closed condition, unless they have been manually tripped. With the BTB closed, the tie bus energizes all other ac buses.

If the APU generator is operating and energizing the ac tie bus, the EPR control circuitry trips the APU-GB. When the APU-GB is opened, the EPR energizes and external power energizes the ac tie bus.

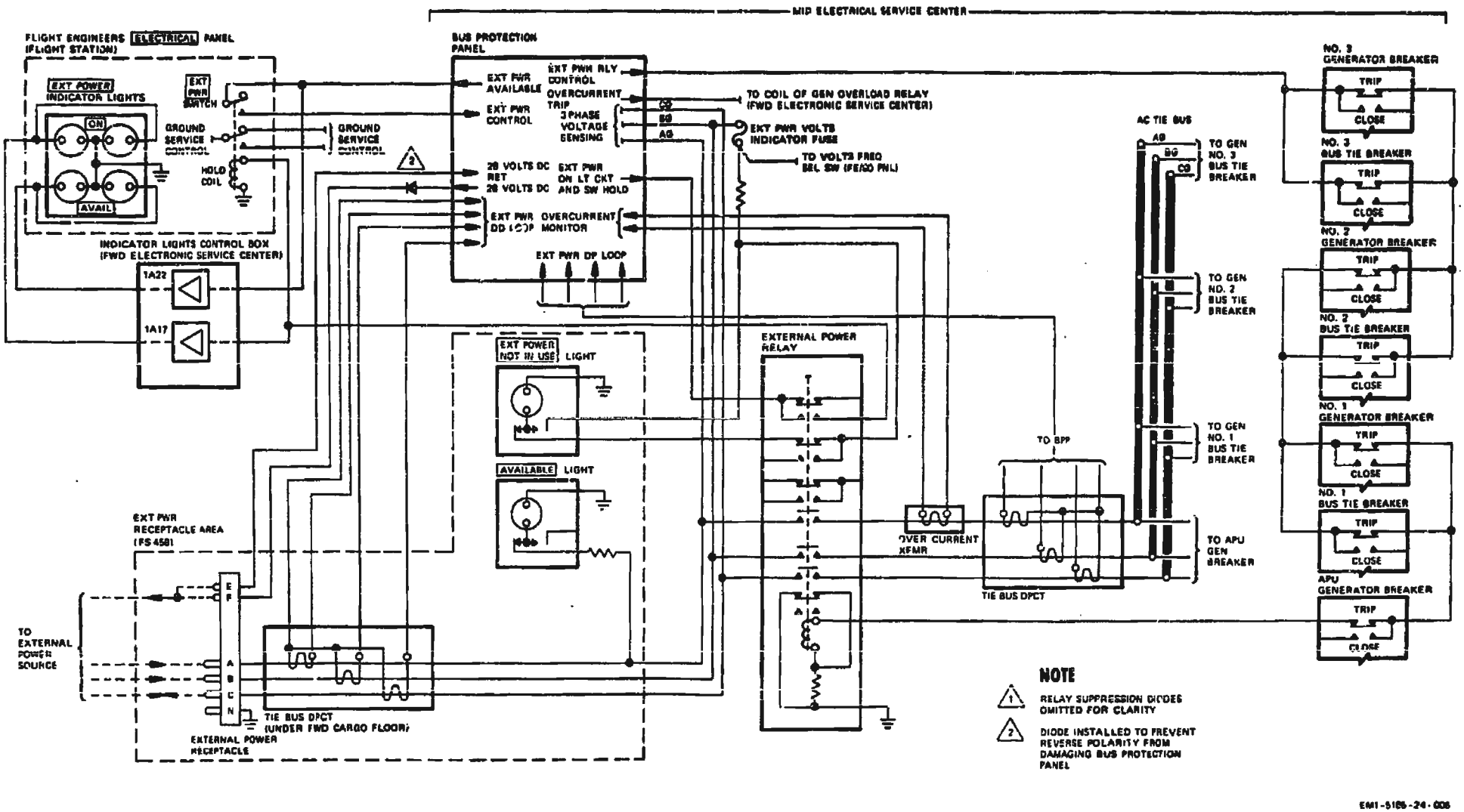
If one or more engine-driven generators are operating and energizing their associated bus, the BPP trips the associated BTB, and external power will be applied to any buses not energized by their own generators. The operating generators will continue to carry their associated buses. As the generators are shut down, external power automatically takes over the buses vacated by the deenergized generators.

Any generator load bus may be removed from external power by depressing the associated TIE BREAKER TRIP switchlight on the Flight Engineer/Second Officers electrical control panel. When this is done, the bus remains isolated from the tie bus until the corresponding CLOSE switchlight is operated.

In the external power condition, the ac essential bus can be energized only from ac bus 3. Therefore, ac bus 3 must be energized, and the essential bus selector switch on the electrical control panel must be in one of the B3 positions.

R A differential protection current transformer is installed at the receptacle and another at the load side of the EPR. A differential current (feeder fault) of 50 (±10) amperes (as sensed by the BPP through the transformers) removes the 28V dc output from the BPP, which deenergizes the EPR and the external power source. A single overcurrent current transformer senses phase A current at the load side of the EPR. An overcurrent condition of 258-275 amperes will trip the galley and the auxiliary hydraulic pump remote control circuit breakers after an inverse time delay.

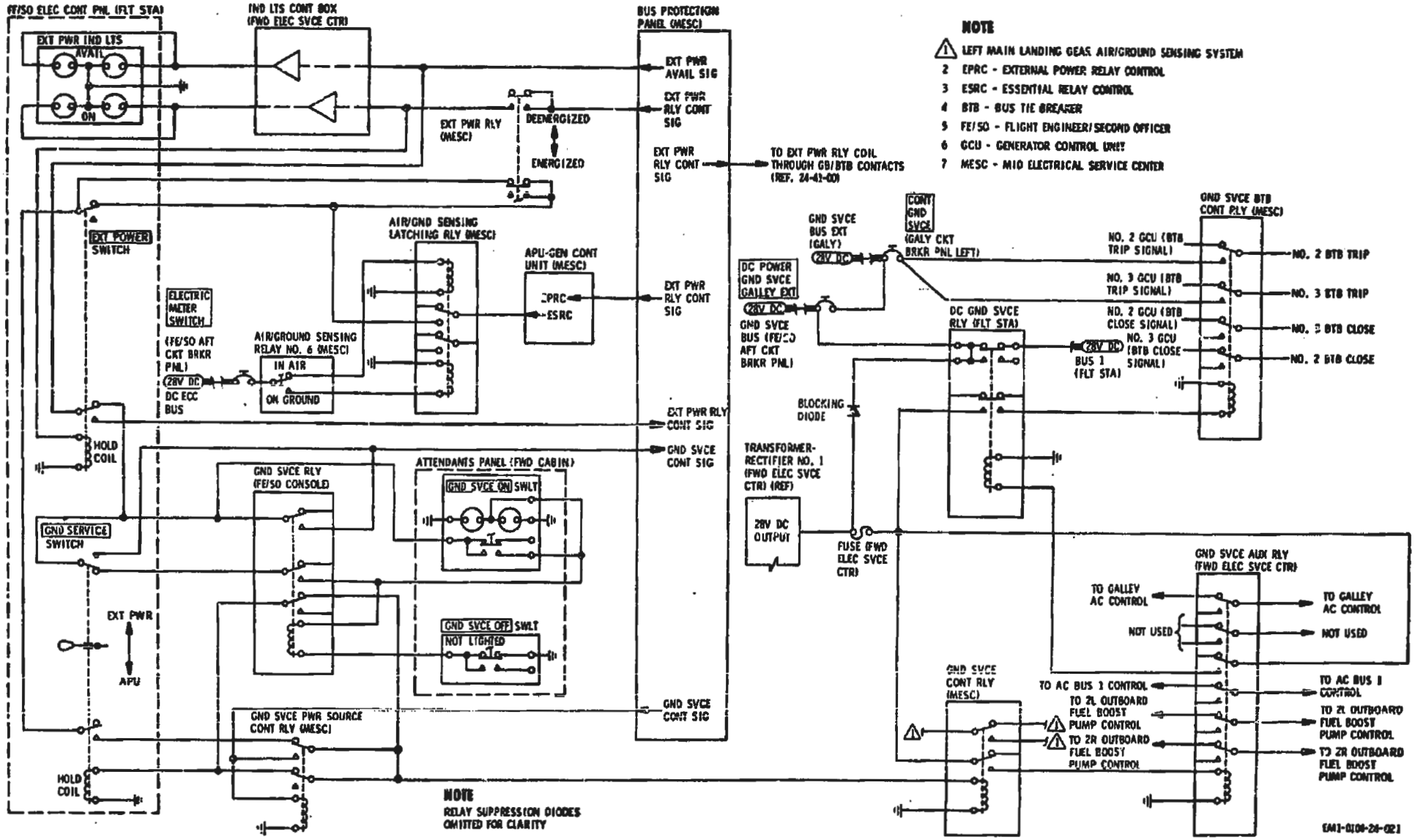
For ground servicing operations (Ref. Fig. 3), a portion of the aircraft circuits can be deenergized by using the ground service control system. For ground servicing operations, an energized external power source is connected to the aircraft (EXT PWR switch OFF and no engines or APU operating). The GND SERVICE control switch on the Flight Engineer/Second Officers electrical control panel is then placed in the EXT PWR position.



R External Power Control System Simplified Schematic
R Figure 2

EFFECTIVITY: ALL

001B



R Ground Service Control System Simplified Schematic
R Figure 3

In this condition, the ground service power source control relay becomes energized and locks in the magnetically held control switch through closed contacts of the deenergized ground service relay. The EPR is also energized by the EPR control circuitry through the external power interlock circuit. The ground service control relay is also energized which, in turn, energizes the ground service auxiliary relay. When energized, the auxiliary relay deenergizes galley ac bus 1, ac bus 1 extension, and the 2L and 2R outboard fuel boost pumps. The relay also energizes the dc ground service relay.

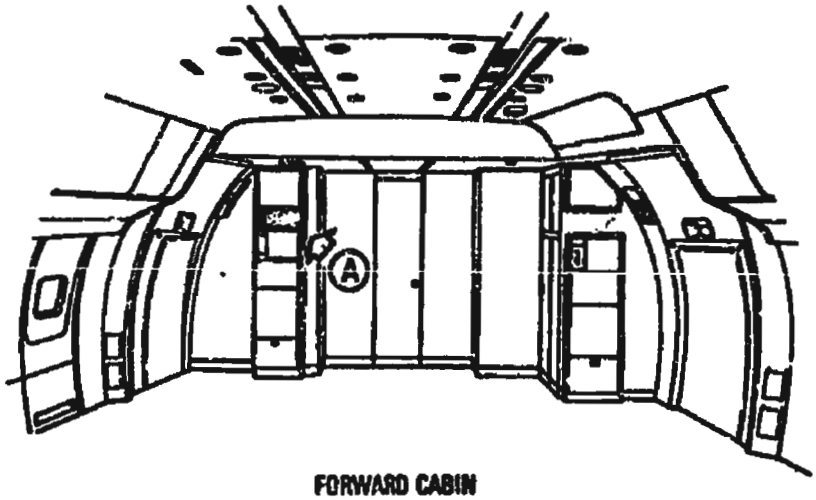
When energized, the dc ground service relay deenergizes dc bus 1 and energizes the ground service BTB control relay. The energized BTB control relay trips both the No. 2 and No. 3 BTB. Tripping BTB 2 deenergizes ac bus 2, galley ac bus 2, passenger service buses 2L and 2R, ac bus 2 extension, and the No. 2 ac radio bus. Tripping BTB 3 deenergizes ac bus 3, galley ac bus 3, passenger service buses 3L and 3R, ac bus 3 extension, and the ac essential bus.

When the ac essential bus is deenergized, the ac essential radio bus and the single-phase ac standby bus are also deenergized. When in the ground service mode, only the following buses remain energized: ac bus 1, passenger service buses 1L and 1R, forward ac ground service bus, and the dc ground service bus and its galley extension.

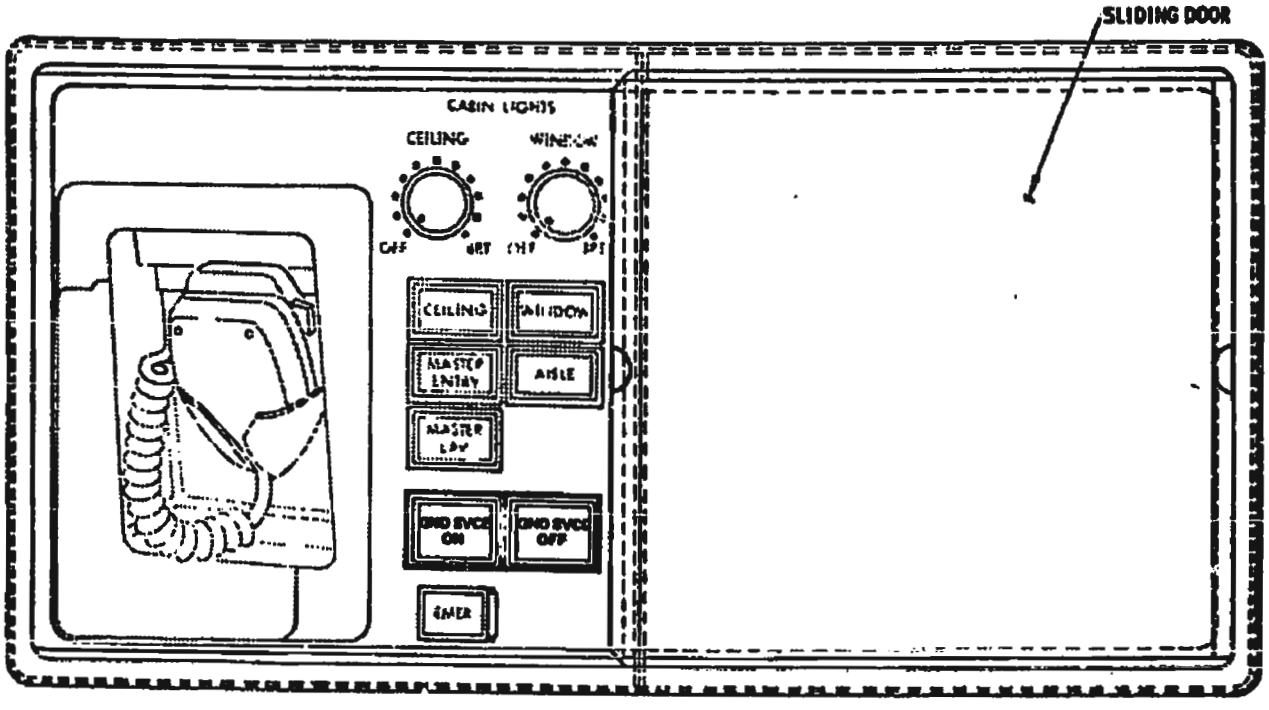
With external power available, the system can also be controlled with the GND SVCE ON and GND SVCE OFF control switchlights (Ref. Fig. 4) on the attendants forward control panel. The attendants panel switchlights do not respond when the APU is used as the power source.

To energize the system from the attendants forward control panel (external power only), the GND SVCE ON switchlight must be depressed. This action will energize and lock in the ground service relay and light the ON light of the switchlight. The locked in ground service relay now energizes the ground service power source control relay and the EPR through circuitry in the BPP. With the ground service relay locked in and the EPR energized, the system is energized as outlined above for flight station control. To deenergize the system, the GND SVCE OFF switchlight must be pressed, which releases the lock-in on the ground service relay and causes the ON light to go off.

If the ground service system was initially energized from the flight station, operation can be terminated from the attendants forward control panel by pressing the GND SVCE ON switchlight to take over control, and then pressing the GND SVCE OFF switchlight. If desired, operation initiated at the attendants forward control panel may be terminated from the flight station



FORWARD CABIN
VIEW LOOKING FORWARD



A
ATTENDANT FOWARD PANEL (ZONE 221)

HH 4385
M1-A00-24-022

Attendants Forward Control Panel
Figure 4

by placing the GND SERVICE control switch in the EXT PWR position and then in the OFF position.

When the available power source is the APU, ground service system operation can be initiated only in the flight station by placing the GND SERVICE switch in the APU position. A dc signal from the APU generator control unit energizes the ground service control relay through latched contacts of the air/ground sensing (latching) relay, through OFF contacts of the EXT PWR switch, and through closed contacts of the GND SERVICE switch. The system then operates the same as in the external power mode, except that power comes from the APU. The APU GB is energized, and the EPR is not energized.

A set of auxiliary EPR contacts, which are closed whenever the relay is deenergized (as when the system is energized by the APU), are in parallel with the EXT PWR switch. With the ground service system energized by the APU, the closed contacts prevent loss of power if the EXT PWR switch is placed in the ON position with external power not available.

R Closure of the tie breakers following use of the ground service
R system, with no generators operating, requires 28V dc from the
R dc standby bus (Ref. Fig. 5). Under these conditions the
R battery is the only possible source for the DC standby bus (Ref.
R 24-52-00). Placing the BATTERY switch, located on the Flight
R Engineer/Second Officers control panel, to ON powers the DC
R standby bus from the battery.

3. External Power Receptacle

A. Description

The 115/200V, three-phase external power receptacle consists of four large (0.436-inch diameter) long pins and two small (0.311-inch diameter) short pins. All six pins are mounted in an insulating plastic base. The inboard ends of the six pins are threaded to provide for connecting electrical cables. The pins are not removable for individual replacement.

Three of the large-diameter pins connect the individual phases of external power to the external power relay. The fourth large-diameter pin serves as a ground connection between the external power unit and the aircraft. The two short, small-diameter pins are used for external power source control and to control the external power relay. The pins are gold plated with an under layer of silver plate. The receptacle is located on the lower right fuselage at FS 458.

4. External Power Relay

A. Description and Operation

The external power relay is a three-pole, single-throw, 120kVA, normally open, nonlatching unit. The relay is used to connect 115/200V ac, three-phase power from the external power receptacle to the main ac tie bus. The relay has three sets of main power contacts, one for each of the three power phases, and six sets of auxiliary contacts. Three of the auxiliary contacts are used in the protective, control, and indicating circuits of the ac system. A fourth set of auxiliary contacts are used in the generator preferential circuit in conjunction with the bus protection panel.

A separate set of contacts, which are paralleled with a resistor in the actuating coil circuit, short out the resistor to allow full current to the coil for positive actuation, and open when the relay is completely actuated. This places the resistor in series with the coil for lower current consumption during periods when the coil is energized for a long time. The external power relay is located in the mid electrical service center, zone 137.

5. Overcurrent Current Transformer

A. Description and Operation

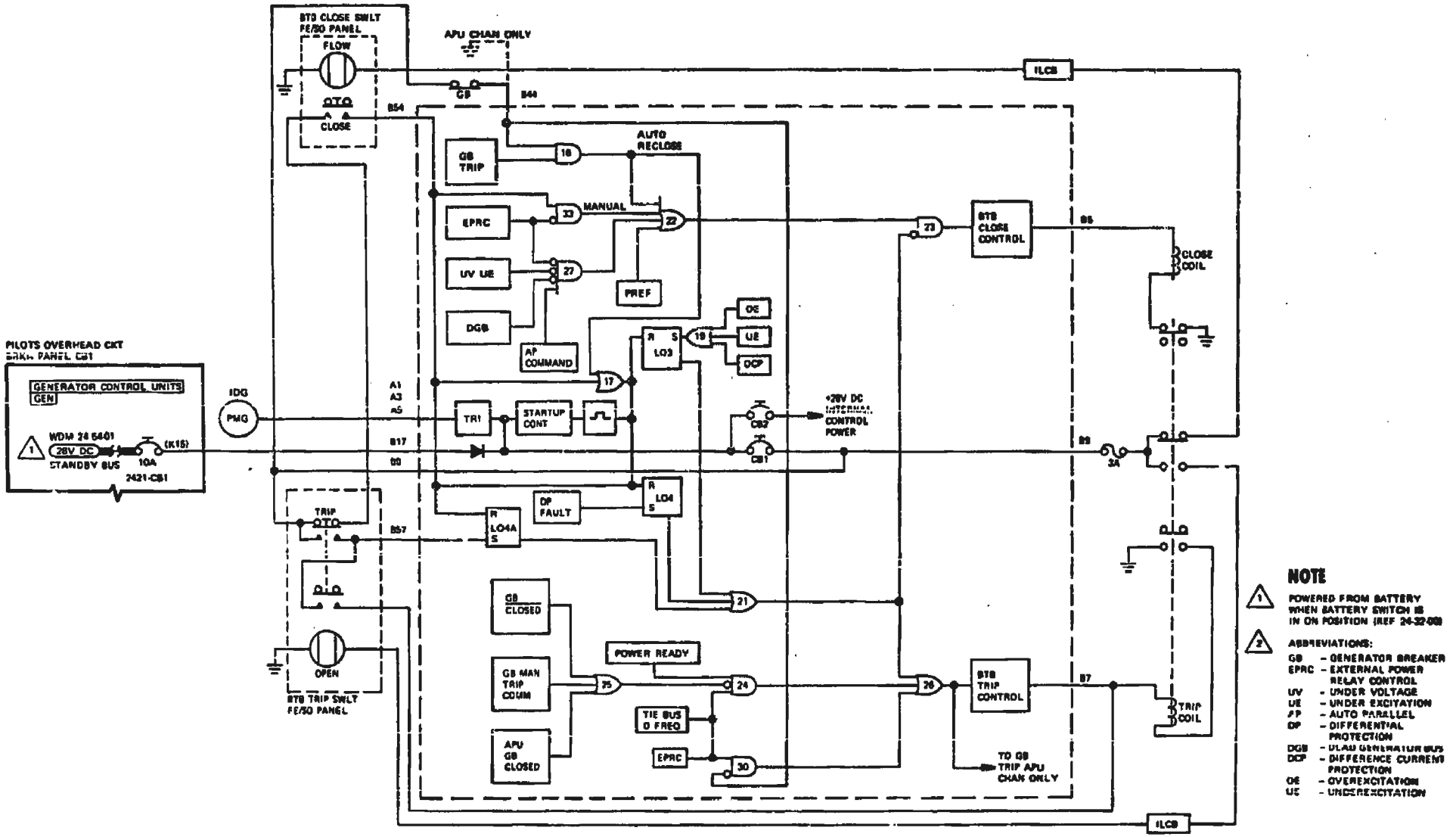
The overcurrent current transformer (Ref. Fig. 6) consists of a single toroid-wound transformer. The transformer is housed in a molded plastic case potted with lightweight epoxy. Connections are provided through two stainless steel studs on top of the unit. Mounting holes in the base plate are spaced to prevent installation in the wrong polarity. The transformer is mounted in the mid electrical service center, zone 137, on the phase A lead from the external power receptacle.

The transformer provides a current signal to the bus protection panel to sense overcurrent conditions in the external power circuit.

6. Ground Service Relay

A. Description and Operation

The dc-operated ground service relay is used in the external power/ground service system to provide lock-in and transfer control of the ground service system. The relay is a polarized, 10-ampere, four-pole, double-throw, sealed unit



NOTE

1. POWERED FROM BATTERY WHEN BATTERY SWITCH IS IN ON POSITION (REF 24-32-00)
2. ABBREVIATIONS:
   - GB – GENERATOR BREAKER
   - EPRC – EXTERNAL POWER RELAY CONTROL
   - UV – UNDER VOLTAGE
   - UE – UNDER EXCITATION
   - AP – AUTO PARALLEL
   - DP – DIFFERENTIAL PROTECTION
   - DGB – DEAD GENERATOR BUS
   - DCP – DIFFERENCE CURRENT PROTECTION
   - OE – OVEREXCITATION
   - UE – UNDEREXCITATION

EM1-0101-24-580

R R Bus Tie Breaker Control Schematic
Figure 5

EFFECTIVITY: ALL

0018

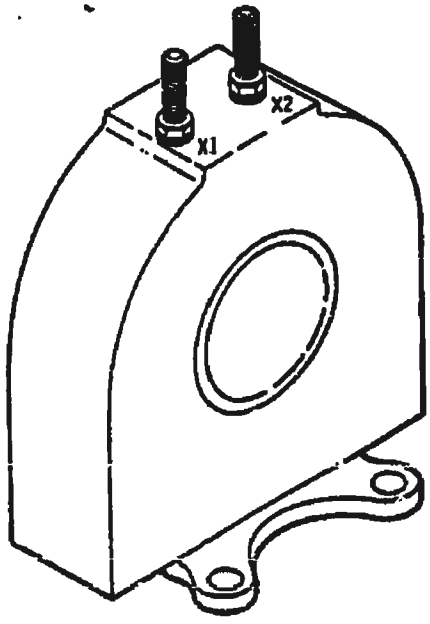
that has 14 gold-over-silver plated plug-in-type contacts. The relay is located in the Flight Engineer/Second Officers console area, zone 215, where it plugs into a prewired socket. The relay has holddown flanges on two sides.

With external power connected, and with the GND SVCE ON (momentary) switch on the attendants forward control panel, zone 223, on, the ground service relay energizes. Once energized, the relay locks in through its own contacts. With the relay energized, the ground service system is energized.

7. Ground Service Bus Tie Breaker Control Relay

A. Description and Operation

The ground service bus tie breaker (BTB) control relay is used in the external power/ground service system to deenergize certain buses whenever the ground service system is in use. The relay is a polarized, 10-ampere, four-pole, double-throw, sealed unit that has gold-over-silver plated plug-in-type contacts. The relay is located in the mid electrical service center, zone 137, where it plugs into a prewired socket. The relay has holddown flanges on two sides.



MM 5421
M1-A00-24-028

R Overcurrent Current Transformer
R Figure 6

The relay is energized by a dc signal whenever the dc ground service relay is energized. When energized, the relay opens control circuits to BTB No. 2 and No. 3, thereby deenergizing ac buses 2 and 3.

8. Ground Service Auxiliary Relay

A. Description and Operation

The dc-operated ground service auxiliary relay is used in the control system to deenergize certain loads when the ground service system is in use. When energized, the relay deenergizes galley ac bus 1, ac bus 1 extension, and 2L and 2R outboard fuel boost pumps. At the same time, the relay energizes the dc ground service relay.

The relay is a polarized, six-pole, double-throw, hermetically sealed unit that has 20 gold-over-silver plated plug-in-type contacts. The relay is located in the forward electronic service center, zone 112, where it plugs into a
R prewired socket. The relay has a hold down flange on each side.

The relay is energized with 28v dc whenever the ground service control relay in the mid electrical service center, zone 137, is energized.

9. Ground Service Power Source Control Relay

A. Description and Operation

The ground service power source control relay selects either the bus protection panel or the APU generator control unit as a power source for the ground service control relay. The relay also provides a lock-in circuit for the GND SERVICE switch on the Flight Engineer/Second Officers electrical control panel, zone 215.

The relay is a polarized, 10-ampere, double-pole, double-throw, sealed and welded unit that has eight gold-over-silver plated plug-in-type contacts. The relay is located in the mid electrical service center, zone 137, where it plugs into a prewired socket. The relay has a holddown flange on each side.

The relay is energized and remains energized whenever the ground service system is energized from external power, and is deenergized when using APU power.

10. Ground Service Control Relay

A. Description and Operation

The ground service control relay is used to energize the ground service auxiliary relay whenever the ground service control system is in use. The relay is energized with 28V dc from the APU generator control unit (GCU), or from the bus protection panel (BPP). The 28V dc signal comes from the GCU or the BPP depending on whether or not the ground service power source control relay is energized.

The relay is a polarized, 10-ampere, double-pole, double-throw, sealed and welded unit that has eight gold-over-silver plated plug-in-type contacts. The relay plugs into a prewired socket in the mid electrical service center, zone 137. The relay has a holddown flange on each side.

The relay is energized whenever the ground service control system is in use. When energized, the relay causes the ground service auxiliary relay in the forward electronic service center, zone 112, to be energized from the dc ground service bus.

11. Air/Ground Sensing Latching Relay

A. Description and Operation

The dc-operated air/ground sensing latching relay is used in the ground service control system. The relay latches in and maintains a circuit from the APU generator control unit (GCU) to the flight station GND SERVICE switch whenever the aircraft is on the ground.

The relay is a polarized, 2-ampere, double-pole, double-throw, hermetically sealed, latching unit that has 10 plug-in-type contacts. The relay plugs into a prewired socket in the mid electrical service center, zone 137, and has a holddown flange on each side.

The relay is energized whenever the aircraft is on the ground and dc bus 1 is energized. The relay, once energized, remains latched in when the dc signal is removed from its actuation coils. The relay unlatches when the aircraft is airborne.

EXTERNAL POWER SYSTEM - FAULT ISOLATION

1. General

Reference data and fault isolation procedures for troubleshooting external power system faults are included in this section of the manual. An external power system malfunction detected by the flight crew is normally entered in the aircraft flight log book and reported to maintenance personnel by a FIRM fault code number. This number and the flight log book write-up can be found in the Chapter 24 Fault Code Index. The index specifies the maintenance manual section, fault isolation diagram figure number and, where appropriate, a block number indicating the entry point containing the fault isolation procedure. When no block number is specified, the entry point is block 1.

Prerequisites listed at the top of each diagram identify mandatory preliminary steps and circuit breakers that must be closed before initiating any fault isolation step.

Schematic diagrams, identified by a SCHEM number, supplement fault isolation procedures as maintenance aids. The schematics show the basic system circuitry necessary for troubleshooting and include cross-reference indexes to the wiring diagram manual pages required for checking component interconnect wiring.

R Figure 101, Component Location Index, is an alphabetical listing
R of all components associated with the External Power system. It
R gives the area and access of each component and its respective
R removal and installation reference.

R Figure 102, Component Locator Diagram, illustrates the location
R on the aircraft of all the components listed in the Component
R Location Index.

R Refer to the Maintenance Manual Introduction for a more detailed
R description of the Fault Isolation Reporting Method (FIRM) and
R use of fault isolation diagrams/schematics.

2. Fault Isolation/Identification

Table 101 is a list of fault isolation data in this section of the manual.

TABLE 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator Diagrams
103	External Power System Fault
104	Ground Service System (External Power) Fault
105	Ground Service System (APU) Fault
SCHEM 1	External Power System Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
BOX – INDICATOR LIGHTS CONTROL	1	FESC; 112AB, ZONE 113	33–17–04
BREAKER			
BUS TIE	1	MESC; 192K, 137AZ	24–21–07
GENERATOR	1	MESC; 192K, 137AZ	24–21–07
CONTROL UNIT – GENERATOR (APU)	1	MESC; 192K, 137AZ	24–21–05
LAMPS – FLOWBAR	2	FE/SO ELECTRICAL CONTROL PANEL	20–33–01
PANEL – BUS PROTECTION	1	MESC; 192K, 137AZ	24–20–03
RELAY:			
DC GROUND SERVICE, 2451-K5	1	FE/SO STATION ZONE 215	20–24–01
EXTERNAL POWER, K1	1	MESC; 192K, 137AZ	24–20–01
GROUND SERVICE, K6	1	FE/SO STATION ZONE 215	20–24–01
GROUND SERVICE AUX, K5	1	FESC; 112AB	20–24–01
GROUND SERVICE BTB CONTROL, 2452-K6	1	MESC; 192K, 137AZ	20–24–01
GROUND SERVICE CONTROL, K2	1	MESC; 192K, 137AZ	20–24–01
SWITCH:			
EXTERNAL POWER	1	FE/SO ELECTRICAL CONTROL PANEL	20–24–01
FE/SO GROUND SERVICE, S1	1	FE/SO ELECTRICAL CONTROL PANEL	20–24–01

M1-0000-24-036

Component Location Index
Figure 101

R EFFECTIVITY: ALL
R
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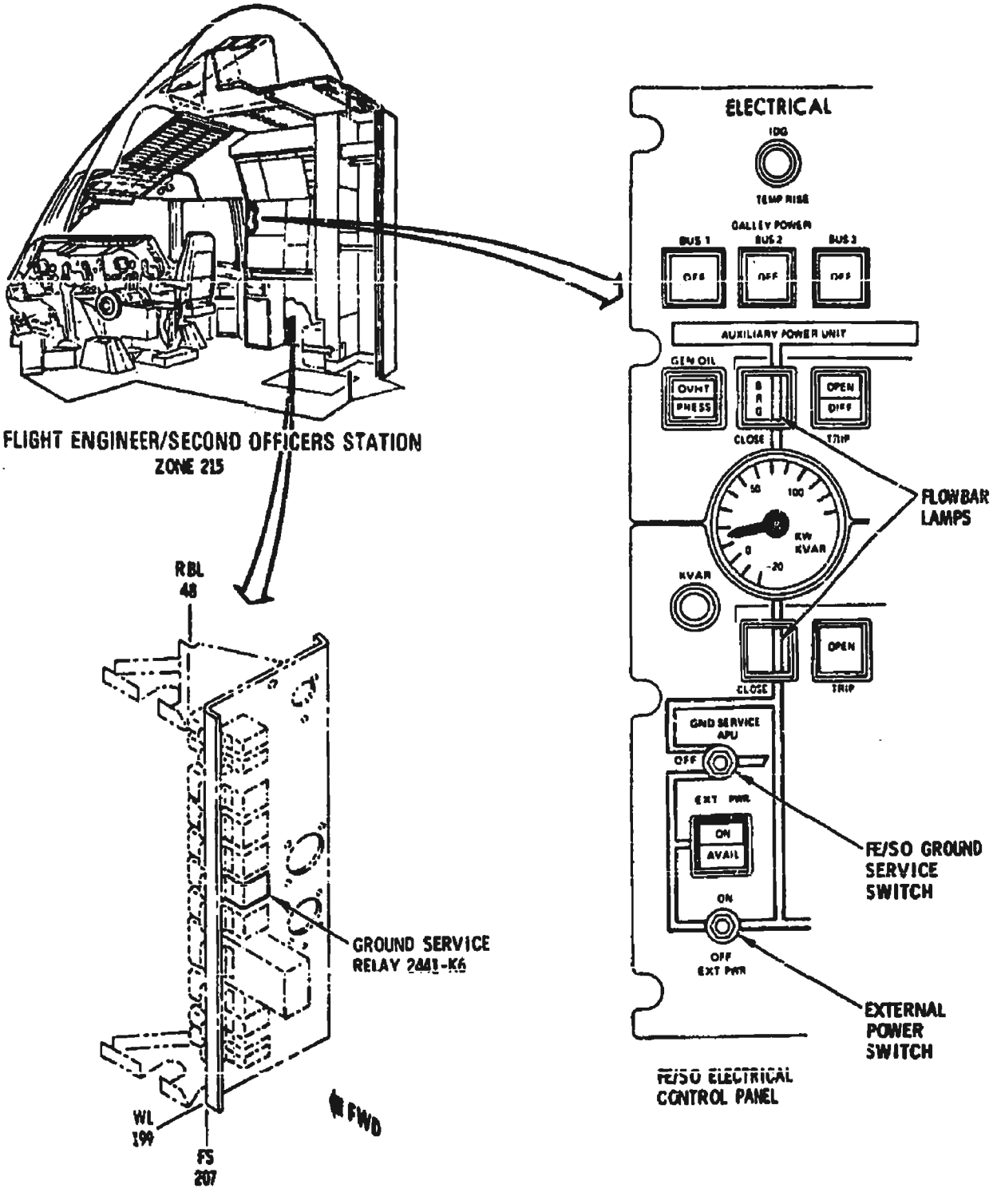
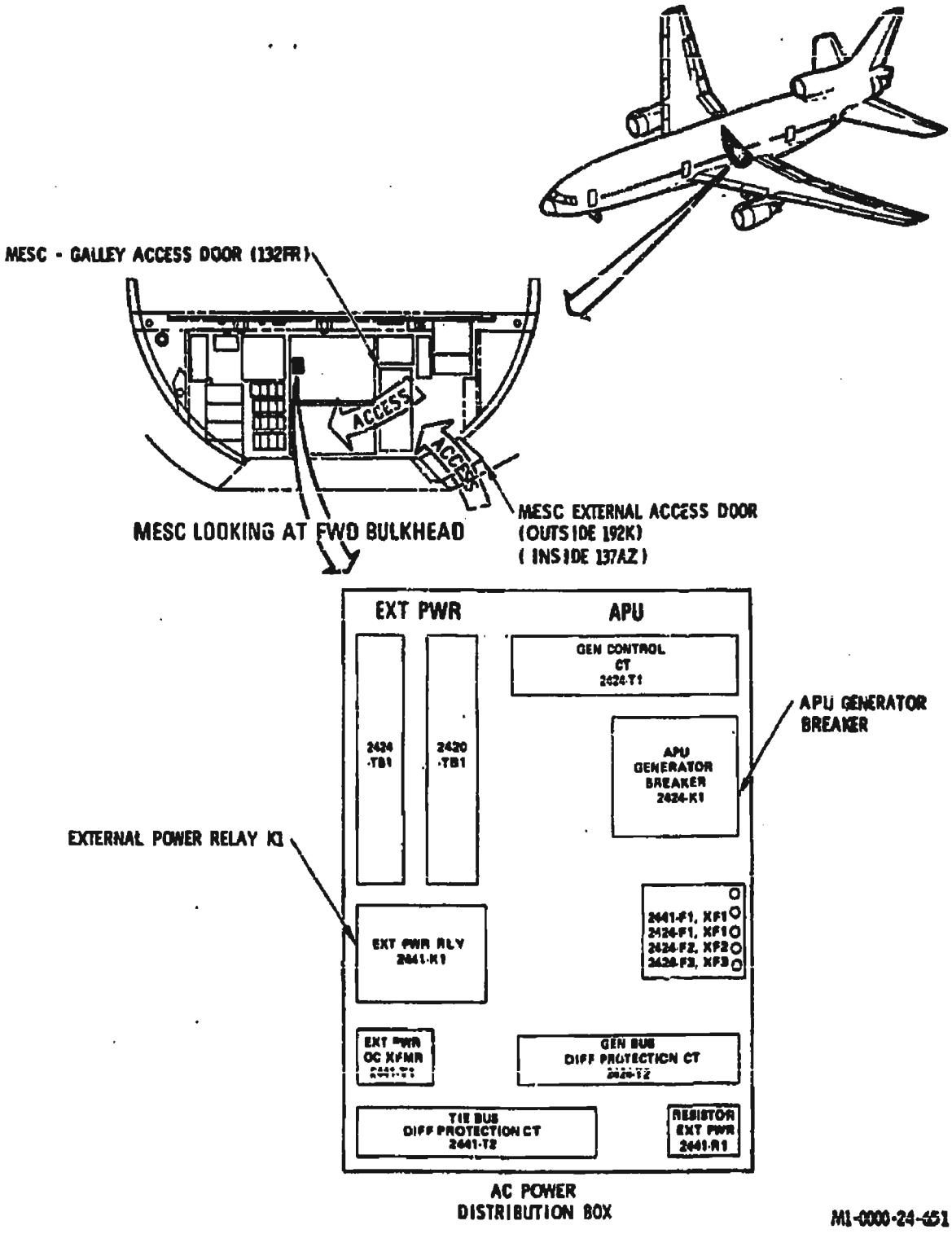


M1-0000-24-450

Component Locator Diagram
Figure 102 (Sheet 1)



Component Locator Diagram
Figure 102 (Sheet 2)

R EFFECTIVITY: ALL
R
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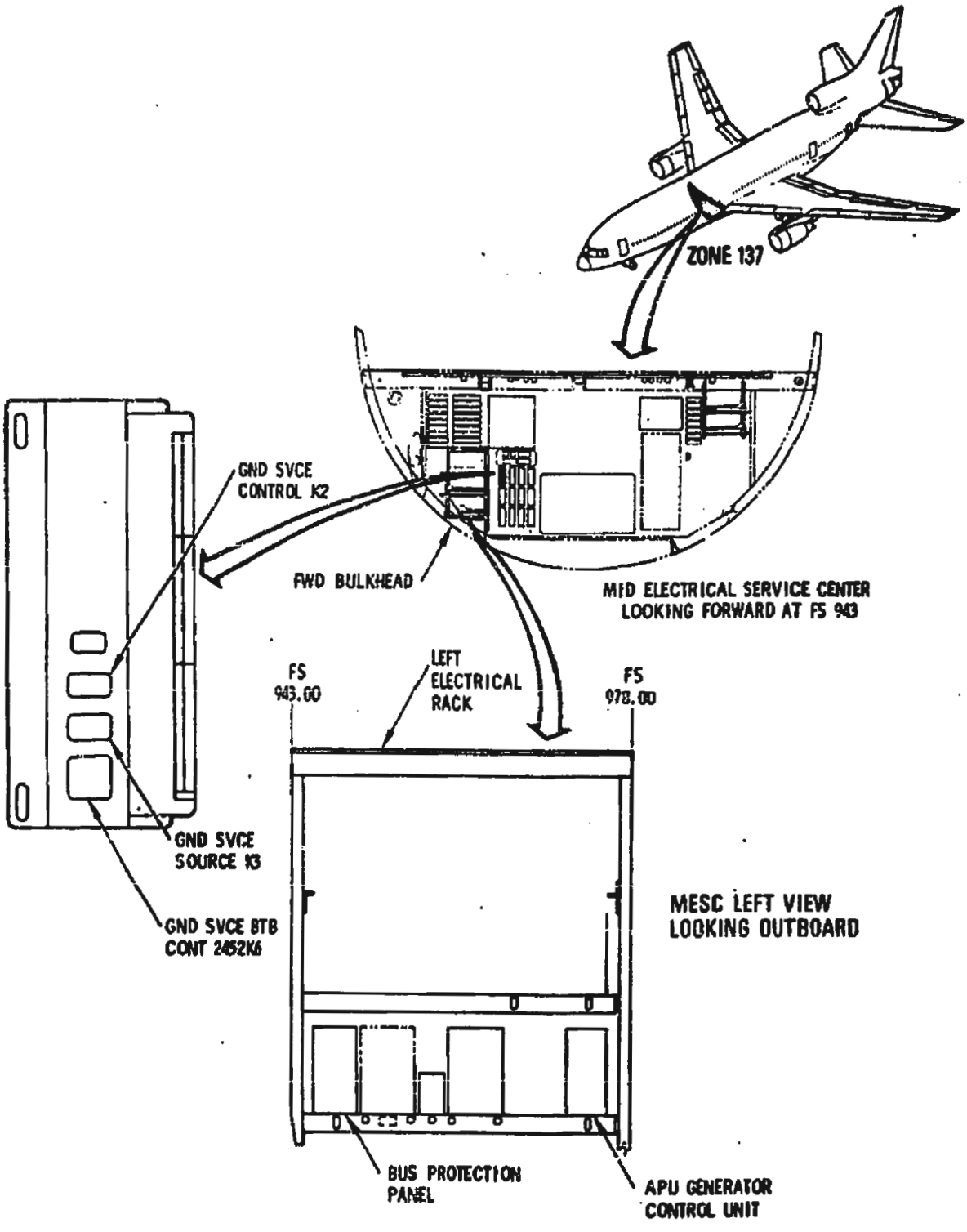
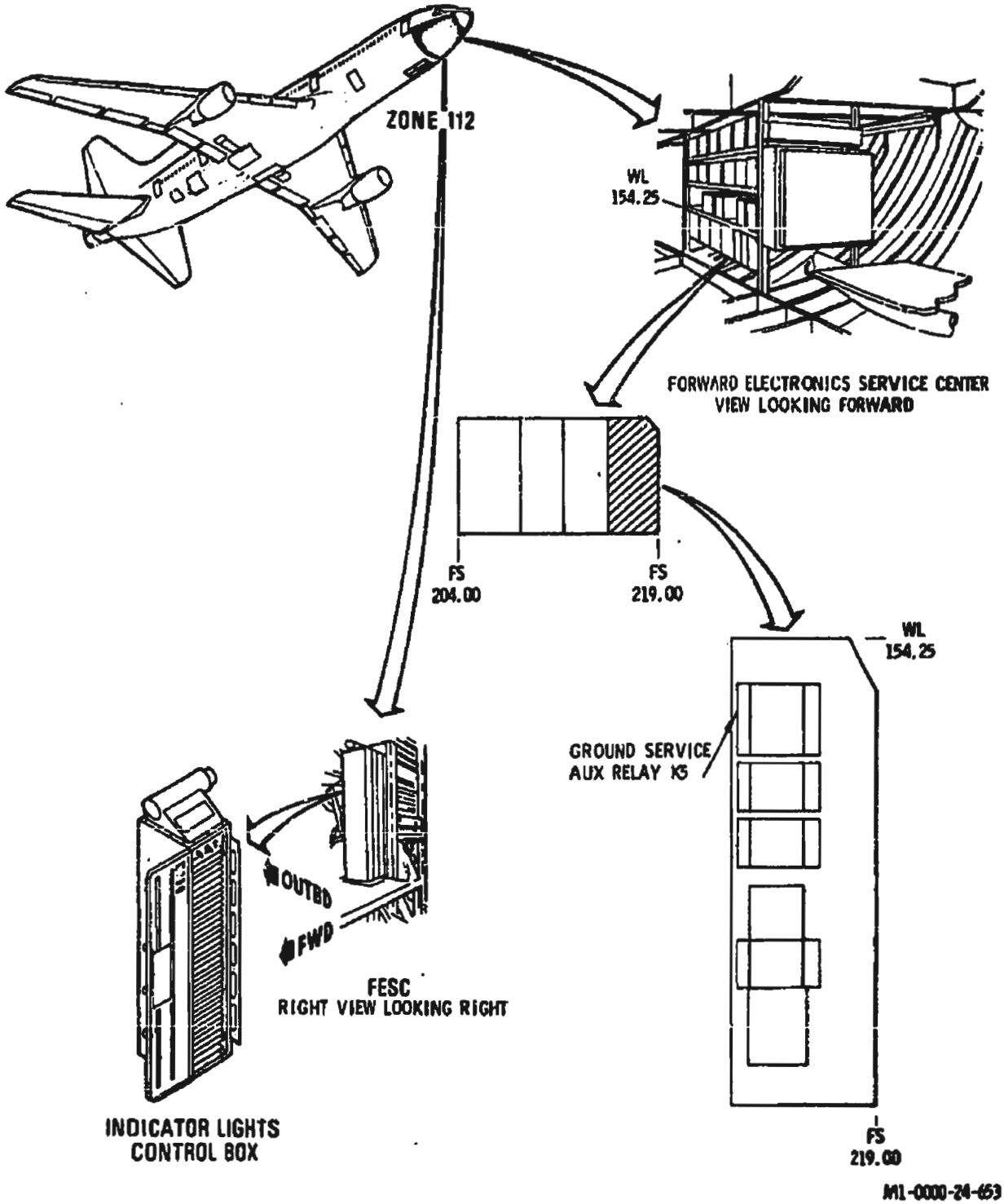
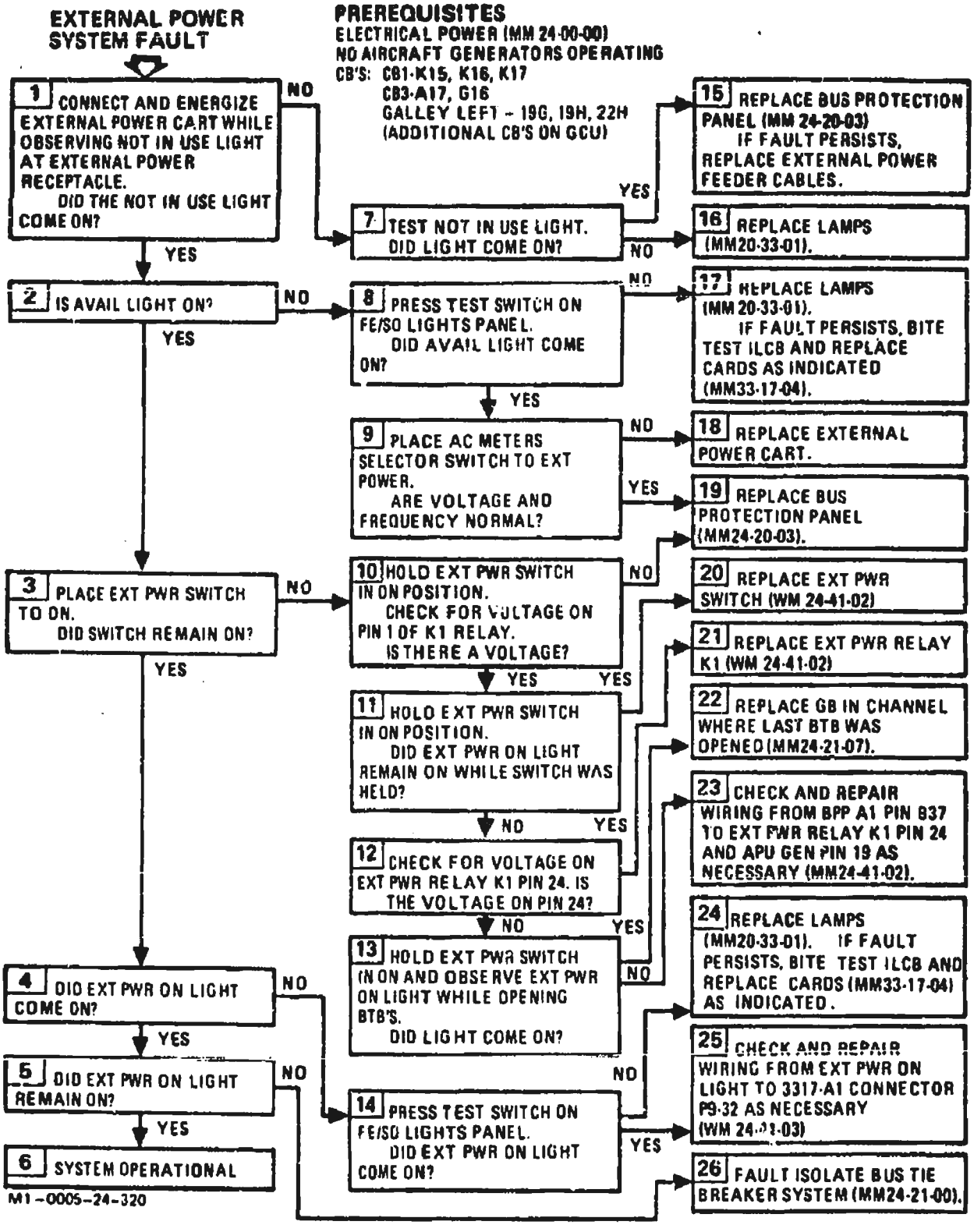


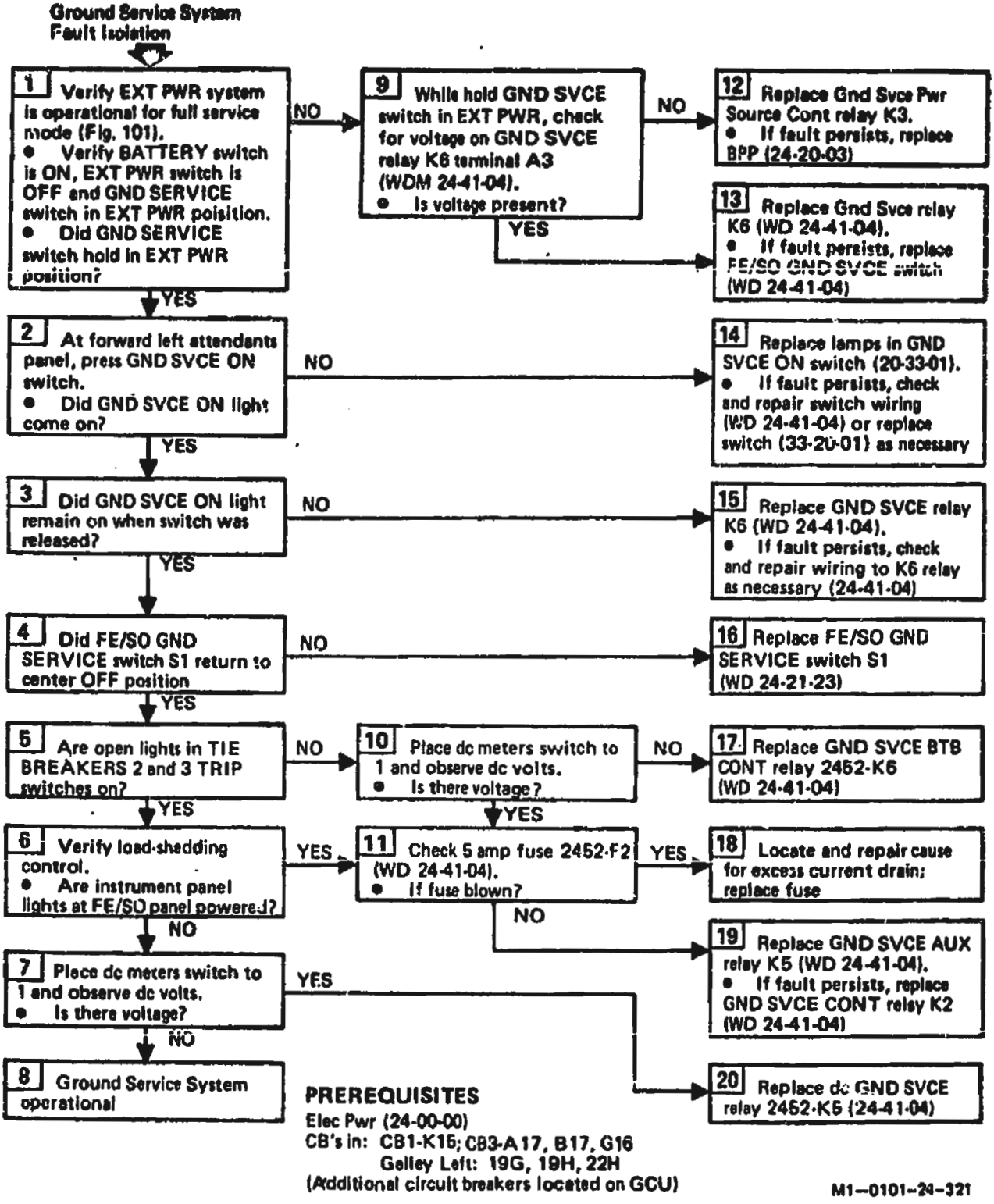
Component Locator Diagram
Figure 102 (Sheet 3)



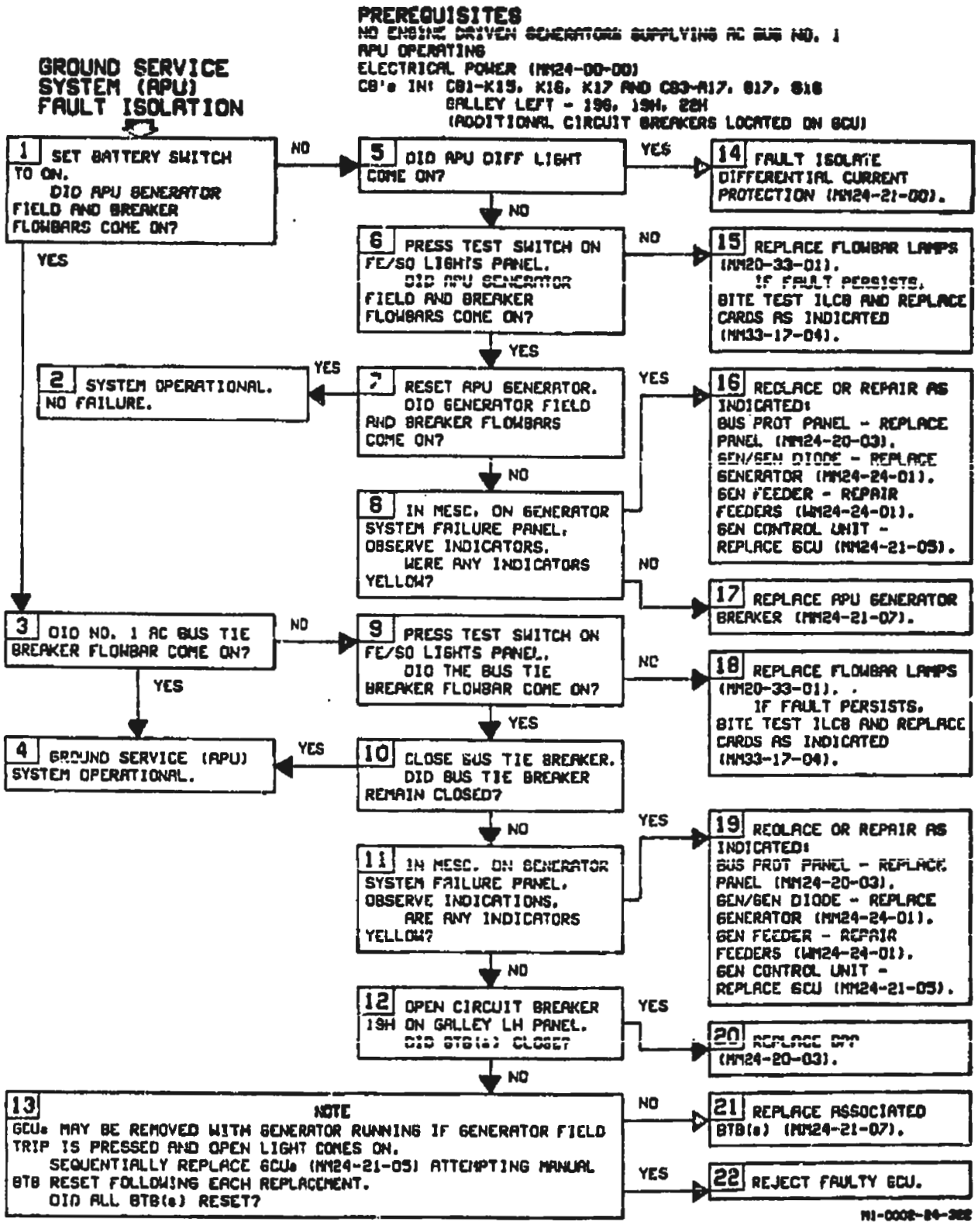
Component Locator Diagram
Figure 102 (Sheet 4)


EXTERNAL POWER SYSTEM FAULT
PREREQUISITES
ELECTRICAL POWER (MM 24-00-00)
NO AIRCRAFT GENERATORS OPERATING
CB'S: CB1-K15, K16, K17
CB3-A17, G16
GALLEY LEFT - 19G, 19H, 22H
(ADDITIONAL CB'S ON GCU)
1 CONNECT AND ENERGIZE EXTERNAL POWER CART WHILE OBSERVING NOT IN USE LIGHT AT EXTERNAL POWER RECEPTACLE. DID THE NOT IN USE LIGHT COME ON?
NO
YES
2 IS AVAIL LIGHT ON?
NO
YES
3 PLACE EXT PWR SWITCH TO ON. DID SWITCH REMAIN ON?
NO
YES
4 DID EXT PWR ON LIGHT COME ON?
NO
YES
5 DID EXT PWR ON LIGHT REMAIN ON?
NO
YES
6 SYSTEM OPERATIONAL
7 TEST NOT IN USE LIGHT. DID LIGHT COME ON?
YES
NO
8 PRESS TEST SWITCH ON FE/SO LIGHTS PANEL. DID AVAIL LIGHT COME ON?
NO
YES
9 PLACE AC METERS SELECTOR SWITCH TO EXT POWER. ARE VOLTAGE AND FREQUENCY NORMAL?
NO
YES
10 HOLD EXT PWR SWITCH IN ON POSITION. CHECK FOR VOLTAGE ON PIN 1 OF K1 RELAY. IS THERE A VOLTAGE?
NO
YES
11 HOLD EXT PWR SWITCH IN ON POSITION. DID EXT PWR ON LIGHT REMAIN ON WHILE SWITCH WAS HELD?
NO
YES
12 CHECK FOR VOLTAGE ON EXT PWR RELAY K1 PIN 24. IS THE VOLTAGE ON PIN 24?
NO
YES
13 HOLD EXT PWR SWITCH IN ON AND OBSERVE EXT PWR ON LIGHT WHILE OPENING BTB'S. DID LIGHT COME ON?
NO
YES
14 PRESS TEST SWITCH ON FE/SO LIGHTS PANEL. DID EXT PWR ON LIGHT COME ON?
NO
YES
15 REPLACE BUS PROTECTION PANEL (MM 24-20-03) IF FAULT PERSISTS, REPLACE EXTERNAL POWER FEEDER CABLES.
16 REPLACE LAMPS (MM20-33-01).
17 REPLACE LAMPS (MM 20-33-01). IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
18 REPLACE EXTERNAL POWER CART.
19 REPLACE BUS PROTECTION PANEL (MM24-20-03).
20 REPLACE EXT PWR SWITCH (WM 24-41-02)
21 REPLACE EXT PWR RELAY K1 (WM 24-41-02)
22 REPLACE GB IN CHANNEL WHERE LAST BTB WAS OPENED (MM24-21-07).
23 CHECK AND REPAIR WIRING FROM BPP A1 PIN B37 TO EXT PWR RELAY K1 PIN 24 AND APU GEN PIN 19 AS NECESSARY (MM24-41-02).
24 REPLACE LAMPS (MM20-33-01). IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS (MM33-17-04) AS INDICATED.
25 CHECK AND REPAIR WIRING FROM EXT PWR ON LIGHT TO 3317-A1 CONNECTOR P9-32 AS NECESSARY (WM 24-41-03)
26 FAULT ISOLATE BUS TIE BREAKER SYSTEM (MM24-21-00).
M1-0005-24-320

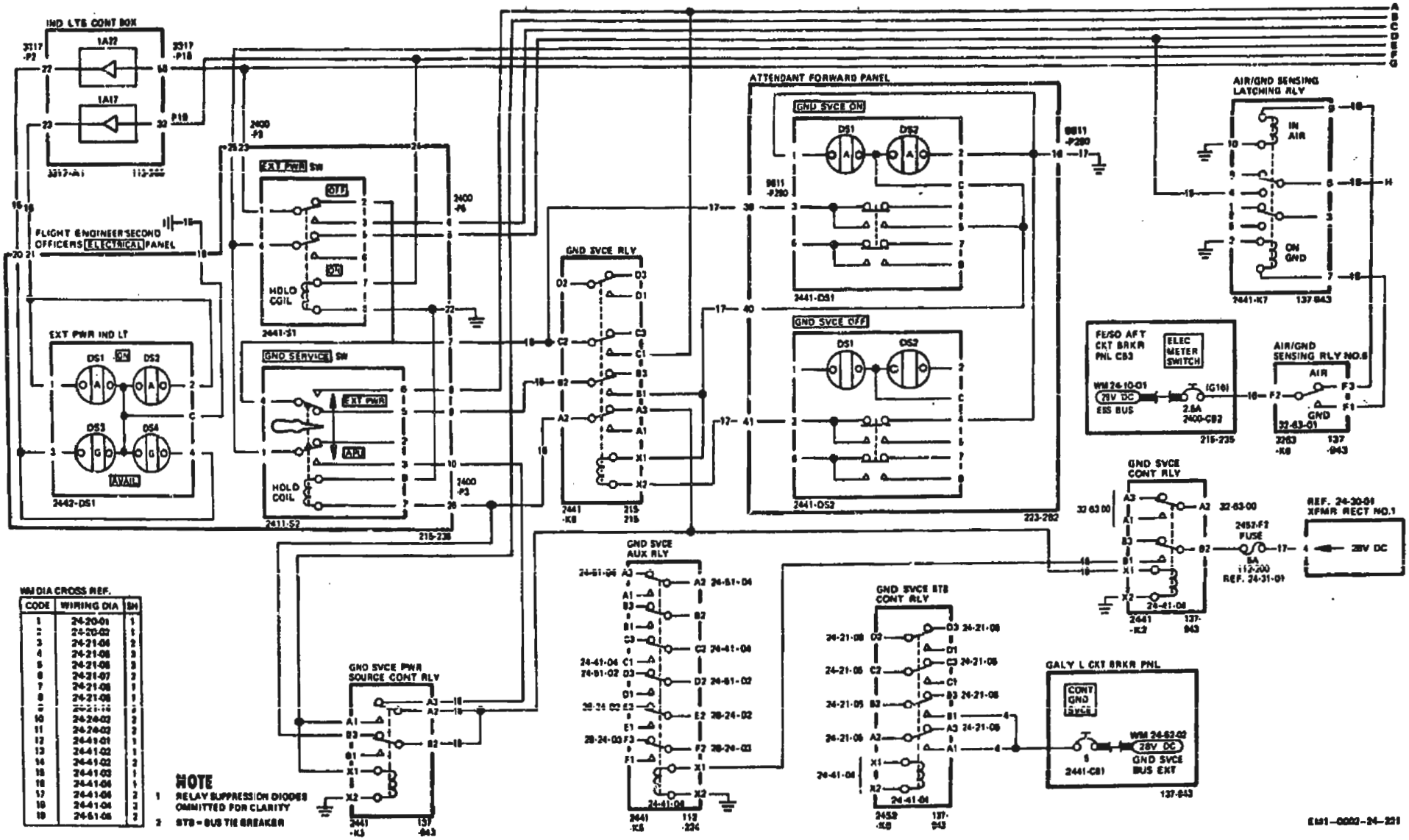
External Power System Fault
Figure 103


Ground Service System Fault Isolation
1 Verify EXT PWR system is operational for full service mode (Fig. 101).
• Verify BATTERY switch is ON, EXT PWR switch is OFF and GND SERVICE switch in EXT PWR position.
• Did GND SERVICE switch hold in EXT PWR position?
NO
YES
2 At forward left attendants panel, press GND SVCE ON switch.
• Did GND SVCE ON light come on?
NO
YES
3 Did GND SVCE ON light remain on when switch was released?
NO
YES
4 Did FE/SO GND SERVICE switch S1 return to center OFF position
NO
YES
5 Are open lights in TIE BREAKERS 2 and 3 TRIP switches on?
NO
YES
6 Verify load-shedding control.
• Are instrument panel lights at FE/SO panel powered?
YES
NO
7 Place dc meters switch to 1 and observe dc volts.
• Is there voltage?
YES
NO
8 Ground Service System operational
9 While hold GND SVCE switch in EXT PWR, check for voltage on GND SVCE relay K6 terminal A3 (WDM 24-41-04).
• Is voltage present?
NO
YES
10 Place dc meters switch to 1 and observe dc volts.
• Is there voltage?
NO
YES
11 Check 5 amp fuse 2452-F2 (WD 24-41-04).
• If fuse blown?
YES
NO
12 Replace Gnd Svce Pwr Source Cont relay K3.
• If fault persists, replace BPP (24-20-03)
13 Replace Gnd Svce relay K6 (WD 24-41-04).
• If fault persists, replace FE/SO GND SVCE switch (WD 24-41-04)
14 Replace lamps in GND SVCE ON switch (20-33-01).
• If fault persists, check and repair switch wiring (WD 24-41-04) or replace switch (33-20-01) as necessary
15 Replace GND SVCE relay K6 (WD 24-41-04).
• If fault persists, check and repair wiring to K6 relay as necessary (24-41-04)
16 Replace FE/SO GND SERVICE switch S1 (WD 24-21-23)
17 Replace GND SVCE BTB CONT relay 2452-K6 (WD 24-41-04)
18 Locate and repair cause for excess current drain; replace fuse
19 Replace GND SVCE AUX relay K5 (WD 24-41-04).
• If fault persists, replace GND SVCE CONT relay K2 (WD 24-41-04)
20 Replace dc GND SVCE relay 2452-K5 (24-41-04)
PREREQUISITES
Elec Pwr (24-00-00)
CB's in: CB1-K15; CB3-A17, B17, G16
Galley Left: 19G, 19H, 22H
(Additional circuit breakers located on GCU)
M1-0101-24-321

Ground Service System (External Power) Fault
Figure 104


GROUND SERVICE SYSTEM (APU) FAULT ISOLATION
PREREQUISITES
NO ENGINE DRIVEN GENERATORS SUPPLYING AC BUS NO. 1
APU OPERATING
ELECTRICAL POWER (MM24-00-00)
CB's IN: CB1-K15, K16, K17 AND CB3-A17, B17, B18
GALLEY LEFT - 19G, 19H, 22H
(ADDITIONAL CIRCUIT BREAKERS LOCATED ON GCU)
1 SET BATTERY SWITCH TO ON. DID APU GENERATOR FIELD AND BREAKER FLOWBARS COME ON?
NO
YES
2 SYSTEM OPERATIONAL. NO FAILURE.
3 DID NO. 1 AC BUS TIE BREAKER FLOWBAR COME ON?
NO
YES
4 GROUND SERVICE (APU) SYSTEM OPERATIONAL.
5 DID APU DIFF LIGHT COME ON?
YES
NO
14 FAULT ISOLATE DIFFERENTIAL CURRENT PROTECTION (MM24-21-00).
6 PRESS TEST SWITCH ON FE/SO LIGHTS PANEL. DID APU GENERATOR FIELD AND BREAKER FLOWBARS COME ON?
NO
YES
15 REPLACE FLOWBAR LAMPS (MM20-33-01). IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
7 RESET APU GENERATOR. DID GENERATOR FIELD AND BREAKER FLOWBARS COME ON?
YES
NO
16 REPLACE OR REPAIR AS INDICATED: BUS PROT PANEL - REPLACE PANEL (MM24-20-03). GEN/GEN DIODE - REPLACE GENERATOR (MM24-24-01). GEN FEEDER - REPAIR FEEDERS (MM24-24-01). GEN CONTROL UNIT - REPLACE GCU (MM24-21-05).
8 IN MISC. ON GENERATOR SYSTEM FAILURE PANEL, OBSERVE INDICATORS. WERE ANY INDICATORS YELLOW?
NO
17 REPLACE APU GENERATOR BREAKER (MM24-21-07).
9 PRESS TEST SWITCH ON FE/SO LIGHTS PANEL. DID THE BUS TIE BREAKER FLOWBAR COME ON?
NO
YES
18 REPLACE FLOWBAR LAMPS (MM20-33-01). IF FAULT PERSISTS, BITE TEST ILCB AND REPLACE CARDS AS INDICATED (MM33-17-04).
10 CLOSE BUS TIE BREAKER. DID BUS TIE BREAKER REMAIN CLOSED?
YES
NO
19 REPLACE OR REPAIR AS INDICATED: BUS PROT PANEL - REPLACE PANEL (MM24-20-03). GEN/GEN DIODE - REPLACE GENERATOR (MM24-24-01). GEN FEEDER - REPAIR FEEDERS (MM24-24-01). GEN CONTROL UNIT - REPLACE GCU (MM24-21-05).
11 IN MISC. ON GENERATOR SYSTEM FAILURE PANEL, OBSERVE INDICATIONS. ARE ANY INDICATORS YELLOW?
NO
12 OPEN CIRCUIT BREAKER 19H ON GALLEY LH PANEL. DID BTB(s) CLOSE?
YES
NO
20 REPLACE BPT (MM24-20-03).
13 NOTE GCUs MAY BE REMOVED WITH GENERATOR RUNNING IF GENERATOR FIELD TRIP IS PRESSED AND OPEN LIGHT COMES ON. SEQUENTIALLY REPLACE GCUs (MM24-21-05) ATTEMPTING MANUAL BTB RESET FOLLOWING EACH REPLACEMENT. DID ALL BTB(s) RESET?
NO
YES
21 REPLACE ASSOCIATED BTB(s) (MM24-21-07).
22 REJECT FAULTY GCU.

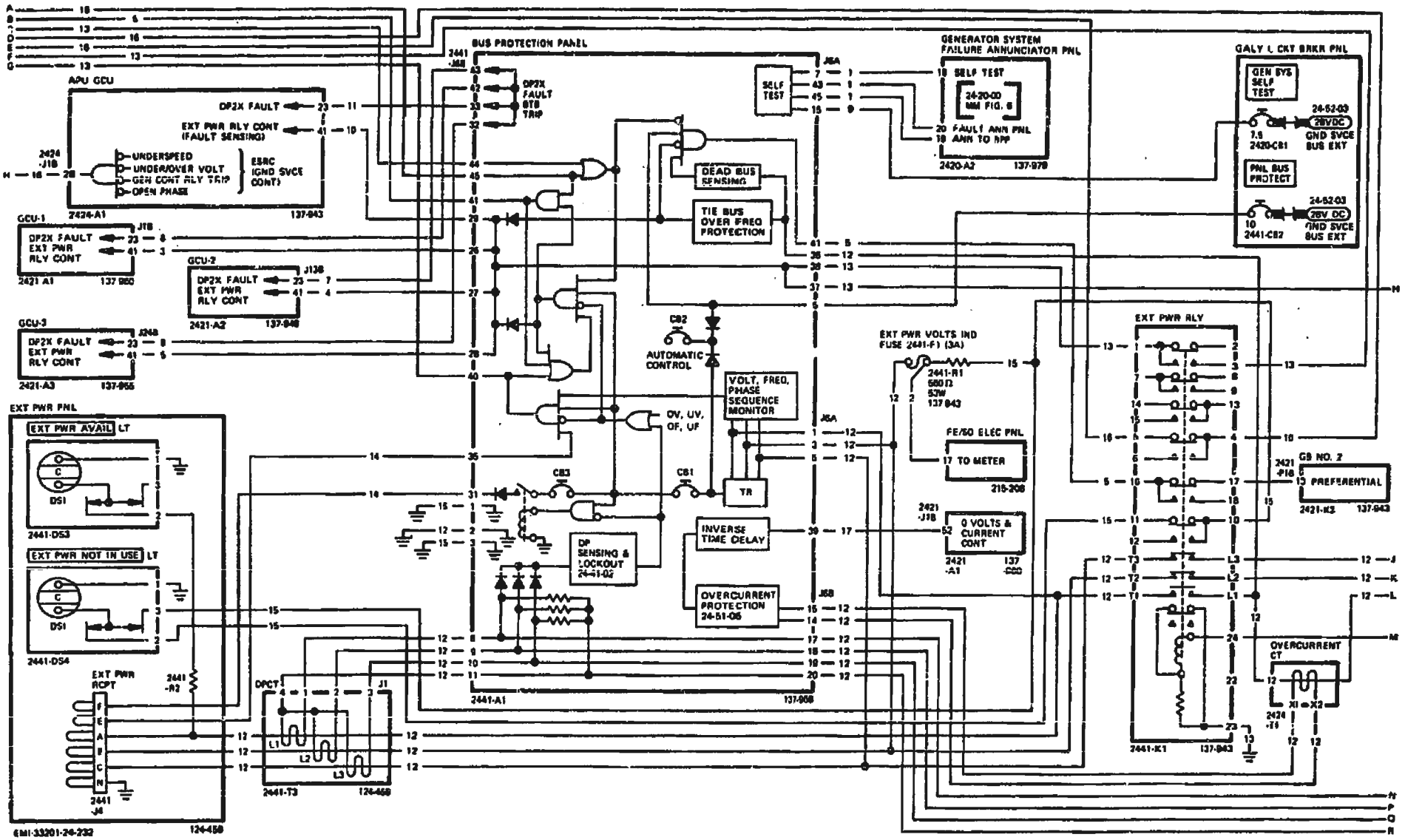
Ground Service System (APU) Fault
Figure 105



External Power System Schematic
SCHEM 1 (Sheet 1)

EFFECTIVITY: ALL

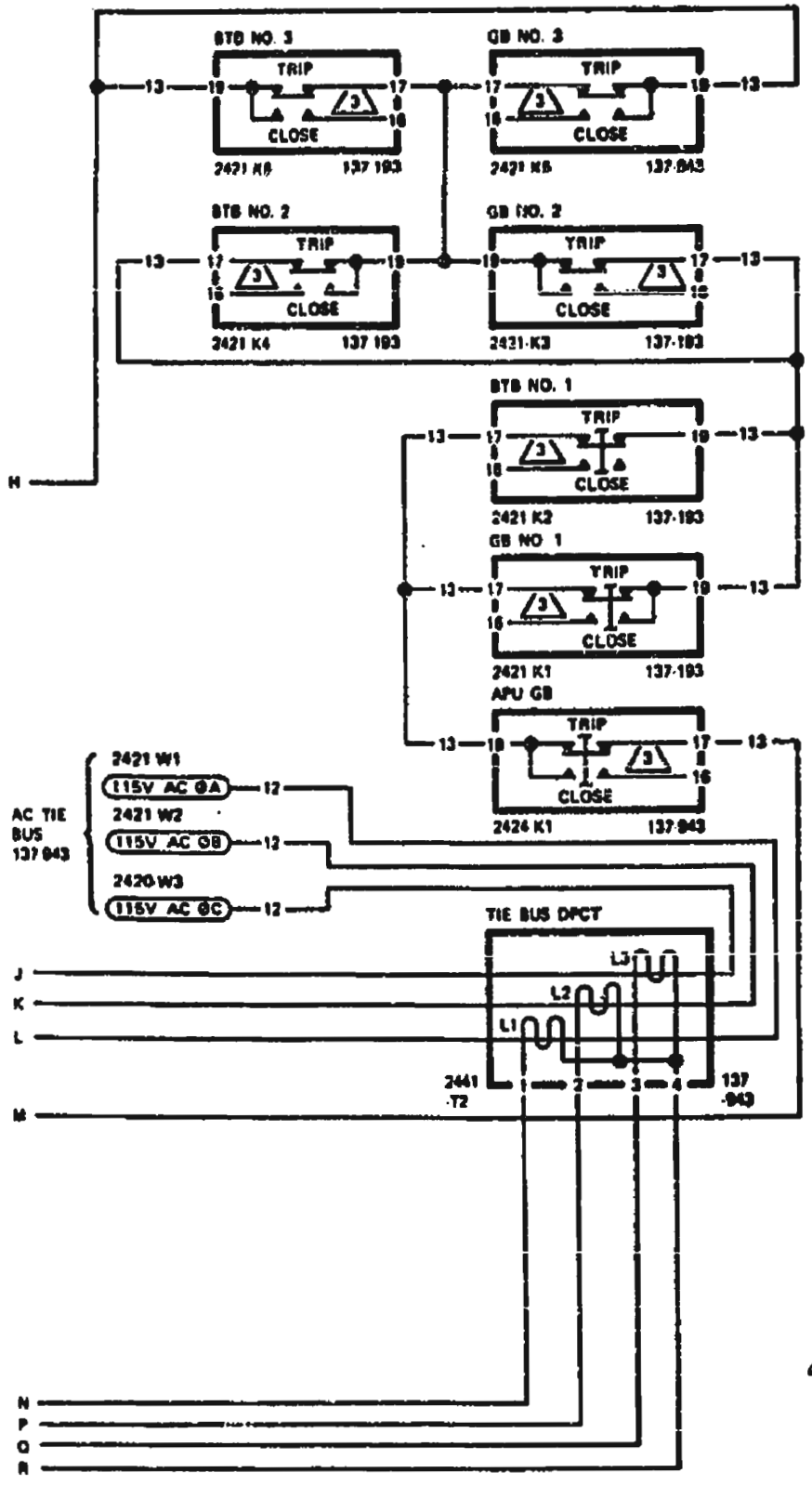
001B



External Power System Schematic
SCHEM 1 (Sheet 2)

EFFECTIVITY: ALL

001B



WDM DIA CROSS REF.

CODE	WIRING DIAGRAM	SH
1	24-20-01	1
2	24-20-02	1
3	24-21-04	2
4	24-21-05	3
5	24-21-06	3
6	24-21-07	2
7	24-21-08	1
8	24-21-09	1
9	24-21-14	2
10	24-24-02	2
11	24-24-03	2
12	24-41-01	1
13	24-41-02	1
14	24-41-02	2
15	24-41-03	1
16	24-41-04	1
17	24-41-04	2
18	24-41-04	3
19	24-51-06	2

NOTE

1 [24-20-00 MM FIG. 8] - CROSS REF. TO MM FIG. IN DIFFERENT ATA NO.

2]4[- NO. IN WIRE PROVIDES CODE FOR WIRING DIA CROSS REF.

3 AUXILIARY CONTACTS

EM1-0001-24-881

R External Power System Schematic
R SCHEM 1 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

EXTERNAL POWER/GROUND SERVICE SYSTEM - MAINTENANCE PRACTICES

1. General

Maintenance or ground servicing may be performed using ac power (Ref. 24-00-00) from the engine-driven generators, the APU generator,or from an external power source. The following procedure covers application of ac power from an external power source to the aircraft buses.

All ground operations may be performed using a power source furnishing 115/200V ac, 3-phase, 400-Hz, ABC phase rotation with a capacity of 90 kVA continuous. If only the ground service system is to be used (no hydraulic system operation), a source capacity of 45 kVA continuous is sufficient. For towing operations, the towing unit must provide the proper output with a 30-kVA continuous rating that is capable of starting a 17-kVA motor.

2. Referenced Procedure

24-00-00 Electrical Power - Maintenance Practices

R 3. Equipment and Materials

R Ram Air Turbine (RAT) Ground Safety Lock, P/N 1304565

R 4. Maintenance Practices

WARNING: BEFORE ENERGIZING ELECTRICAL SYSTEM, ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED. HIGH VOLTAGES CAN BE FATAL.

R CAUTION: INSTALL RAM AIR TURBINE (RAT) GROUND SAFETY LOCK (REF.
R 29-21-00, PAGE 201).

A. External Power Application Procedure

(1) Connect proper external power source to receptacle on forward lower fuselage, zone 124 (FS 458).

(2) Energize external power source.

(3) Energize aircraft buses using the following procedures:

(a) In receptacle area, verify that EXT POWER - AVAILABLE and NOT IN USE lights come on. (b) On

FE/SO ELECTRICAL panel, zone 215, verify that external power AVAIL light comes on.

(c) On ELECTRICAL panel, place volts-frequency selector switch in EXT POWER position and verify 111 - 120V ac and 400 ±10 HZ on adjacent AC VOLTS and FREQ indicators.

(d) On ELECTRICAL panel, place magnetically held EXT PWR switch in ON position and verify that adjacent external power ON light comes on (AVAIL light remains on).

(e) In external power receptacle area, verify that NOT IN USE light goes off. Push and release light to verify that light comes on.

NOTE: AVAILABLE light remains on.

(f) On FE/SO ELECTRICAL panel, verify that NO. 1 GND SERVICE BUS, NO. 2 BUS, and NO. 3 BUS - TIE BREAKER - CLOSE (bar) lights are on and that corresponding TRIP lights and FLT STA BUS FAIL lights are off.

NOTE: If any or all bus tie breakers are open, momentarily place BATTERY switch in ON position and if necessary, depress affected TIE BREAKER - CLOSE switchlight.

(g) AC buses 1, 2, and 3 are automatically energized with external power unless the bus is being energized from its associated engine-driven generator. (If desired, press corresponding GENERATOR BREAKER - TRIP switchlight to isolate bus from generator.

NOTE: AC bus 1, 2, or 3 will be energized from its associated engine-driven generator (with external power on) any time the associated generator is operating, unless manually tripped.

B. If ground service only is required:

(1) Energize system by placing the EXT PWR switch in OFF position and the GND SERVICE switch in EXT PWR position.

(2) Check that AVAIL and ON lights above EXT PWR switch are on.

(3) If ground service system does not energize, place the BATTERY switch in the ON position and then in the OFF position. Repeat Step B(2).

NOTE: When using external power, the ground service system can be controlled with GND SVCE ON and GND SVCE OFF switchlights located on the attendants forward control panel, zone 223.

C. Removal of External Power

NOTE: When the ground service system is in use, all ac buses except ac bus 1, passenger service buses 1L and 1R, and the forward ac ground service bus are deenergized.

(1) To deenergize ground service system from station not used to energize, place switch in ON position to take over control, and then deenergize system by placing switch in OFF position.

(2) When external power is no longer required, place EXT PWR switch in OFF position and verify that external power ON light goes off and AVAIL light remains on until external power source is deenergized or disconnected from receptacle.

EXTERNAL POWER/GROUND SERVICE SYSTEM - ADJUSTMENT AND TEST

1. Adjustment/Test

A. Operational Test

(1) On bus protection panel and generator control units No. 1, 2, and 3, zone 137, verify that circuit breakers CB1 and CB2 are closed.

(2) Connect external power source having the correct voltage, frequency, phase rotation, and power output capability, to the external power receptacle, zone 124.

(3) Energize external power source.

(4) In receptacle area, verify that EXT POWER - AVAILABLE and NOT IN USE lights come on.

(5) On FE/SO ELECTRICAL panel, zone 215, verify that external power AVAIL light comes on.

(6) On ELECTRICAL panel, place volts-frequency selector switch in EXT POWER position and verify 115(±2.5)V ac and 400 (±10)Hz on adjacent AC VOLTS and FREQ indicators.

(7) On ELECTRICAL panel, place magnetically held EXT PWR switch in ON position and verify that adjacent external power ON light comes on (AVAIL light remains on).

(8) On ac power distribution box, zone 137, verify that TIE BUS POWER ON light is on.

(9) In external power receptacle area, verify that EXT POWER - NOT IN USE light goes off. Push and release light to verify that light comes on.

NOTE: EXT POWER - AVAILABLE light remains on.

(10) On FE/SO ELECTRICAL panel, verify that NO. 1 GND SERVICE BUS, NO. 2 BUS, and NO. 3 BUS - TIE BREAKER - CLOSE (bar) lights are on and that corresponding TRIP lights and FLT STA BUS FAIL lights are off.

NOTE: If any or all bus tie breakers are open, momentarily place BATTERY switch in ON position and if necessary, depress affected TIE BREAKER - CLOSE switchlight. Place BATTERY switch in OFF position.

(11) Place EXT PWR switch in OFF position and verify that external power ON light goes off and AVAIL light remains on until external power source is deenergized or disconnected from receptacle.

EXTERNAL POWER RECEPTACLE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Receptacle, Burton Electrical Engineering Co., or equivalent

R Wear Set F70284-1, Spec-Tool Co., or equivalent

2. Referenced Procedures

6-50-00	Interior Access Doors
24-41-00	External Power/Ground Service System - Maintenance Practices

3. Removal/Installation

A. Removal

(1) De-energize external power source (Ref. 24-41-00).

(2) Remove external power plug from receptacle located on lower fuselage just aft of nose wheel at FS458 and tag receptacle.

(3) Gain access to receptacle by removing 12- by 14-inch access panel in forward cargo compartment right forward floor panel, FS 458, BL13 (Ref. 6-50-00).

(4) Remove screws, washers, and nuts holding conductor guard, and remove guard (Ref. Fig. 401).

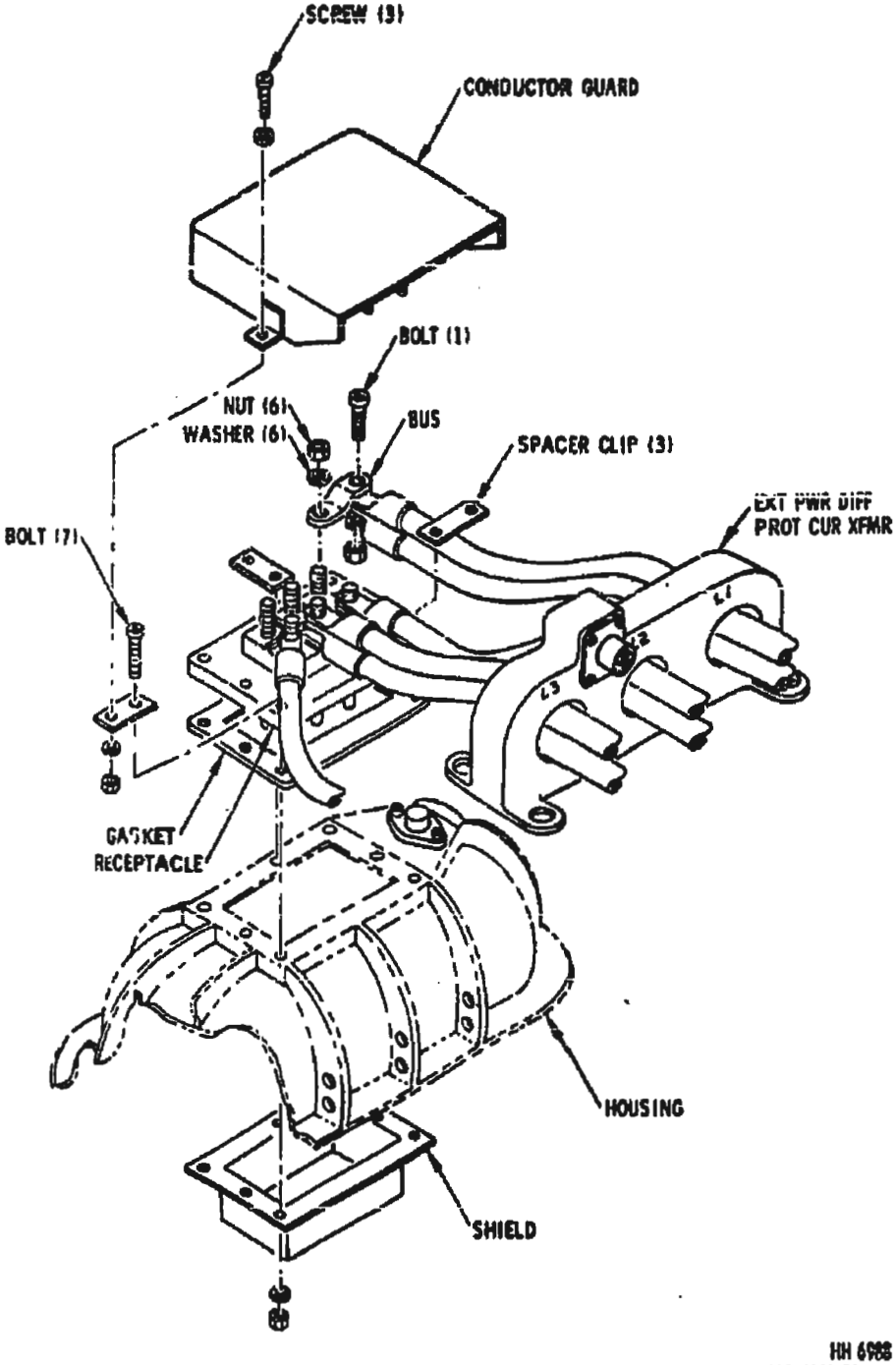
(5) Tag and remove leads and ground lug from terminals.

(6) Remove retaining nuts, washers, and bolts on receptacle (note positions of the three clips).

(7) Remove receptacle from inside aircraft and shield from outside aircraft.

(8) Inspect rubber gasket for condition; re-use if undamaged.

R (9) Inspect receptacle pins, by sliding Wear Set over each R pin. If Wear Set will not slide on the pin, the pin is R acceptable. If Wear Set slides on and falls off from R its own weight, reject the pin, and replace the R receptacle.



R External Power Receptacle - Removal and Installation
R Figure 401

B. Installation

(1) Install gasket and receptacle using bolts, washers, and nuts. Install clips under three screw heads.

NOTE: Insert bolts from inside aircraft and shield from outside aircraft before installing washers and nuts.

C C C (2) Remove tags and install leads on applicable receptacle terminals, and torque four 3/8 by 24 nuts 140 to 160 lb in.; torque two 10 by 32 nuts 20 to 25 lb in.

(3) Install conductor guard using screws, washers, and nuts.

(4) Test external power receptacle as follows. (All controls are on Flight Engineer/Second Officers electrical control panel, zone 215.)

WARNING: BEFORE ENERGIZING ELECTRICAL SYSTEM, ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED. HIGH VOLTAGES CAN BE FATAL.

(5) Apply external power (Ref. 24-41-00) to receptacle.

(6) Check that EXT POWER - NOT IN USE and AVAILABLE (at receptacle) and EXT POWER AVAIL (electrical control panel) lights come on.

(7) Place EXT PWR switch in ON position, and verify that ON light (above switch) comes on. Check that EXT POWER NOT IN USE light next to receptacle goes off.

(8) Place EXT PWR switch in OFF position.

(9) Deenergize and disconnect external power source (Ref. 24-41-00).

(10) Reinstall access panel.

EXTERNAL POWER RELAY - REMOVAL AND INSTALLATION

R 1. Referenced Procedures

6-40-00	External Access Doors and Removable Panels - Description and Operation
6-50-00	External Access Doors and Removable Panels - Description and Operation
24-41-00	External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breakers APU POWER CONTROL and IGNITION.

(2) On pilots center console, zone 210, ensure that FUEL AND IGNITION switches are in OFF position and tagged.

(3) On Flight Engineer/Second Officers electrical control panel, zone 215, place EXT PWR switch in OFF position and tag.

(4) Turn off external power source (Ref. 24-41-00).

(5) Remove external power plug from receptacle located on the lower fuselage just aft of the nosewheel well at FS 458, and tag receptacle.

(6) Gain access to mid electrical service center, zone 137 (Ref. 6-40-00, 6-50-00).

(7) Release Camloc fasteners and open APU door section of the ac power distribution box for access to the external power relay (Ref. Fig. 401).

WARNING: USE CAUTION IN THE AC POWER DISTRIBUTION BOX. VOLTAGES CAN BE FATAL.

(8) Remove screws and protective cover from external power relay (Ref. Fig. 401).

(9) Tag and remove wires from external power relay terminal studs T1, T2, T3, L1, L2, and L3.

(10) Disengage electrical connector from external power relay.

(11) Tag and remove screw and ground wire from external power relay mounting flange.

(12) Remove remaining mounting screws and remove external power relay from ac power distribution box.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Verify that control switches are properly positioned and tagged [Steps 2A(2) and 2A(3)].

(3) Position external power relay (receptacle on top) and secure with screws.

NOTE: Ground wire is secured with upper left screw.

(4) Engage electrical connector to receptacle on external power relay.

R (5) Reconnect tagged wires to proper terminals and remove tags; secure with terminal nuts.

(6) Position protective cover and secure with screws.

(7) Close and secure APU door section of the ac power distribution box.

(8) Close and secure ground access doors.

(9) Remove tag from external power receptacle.

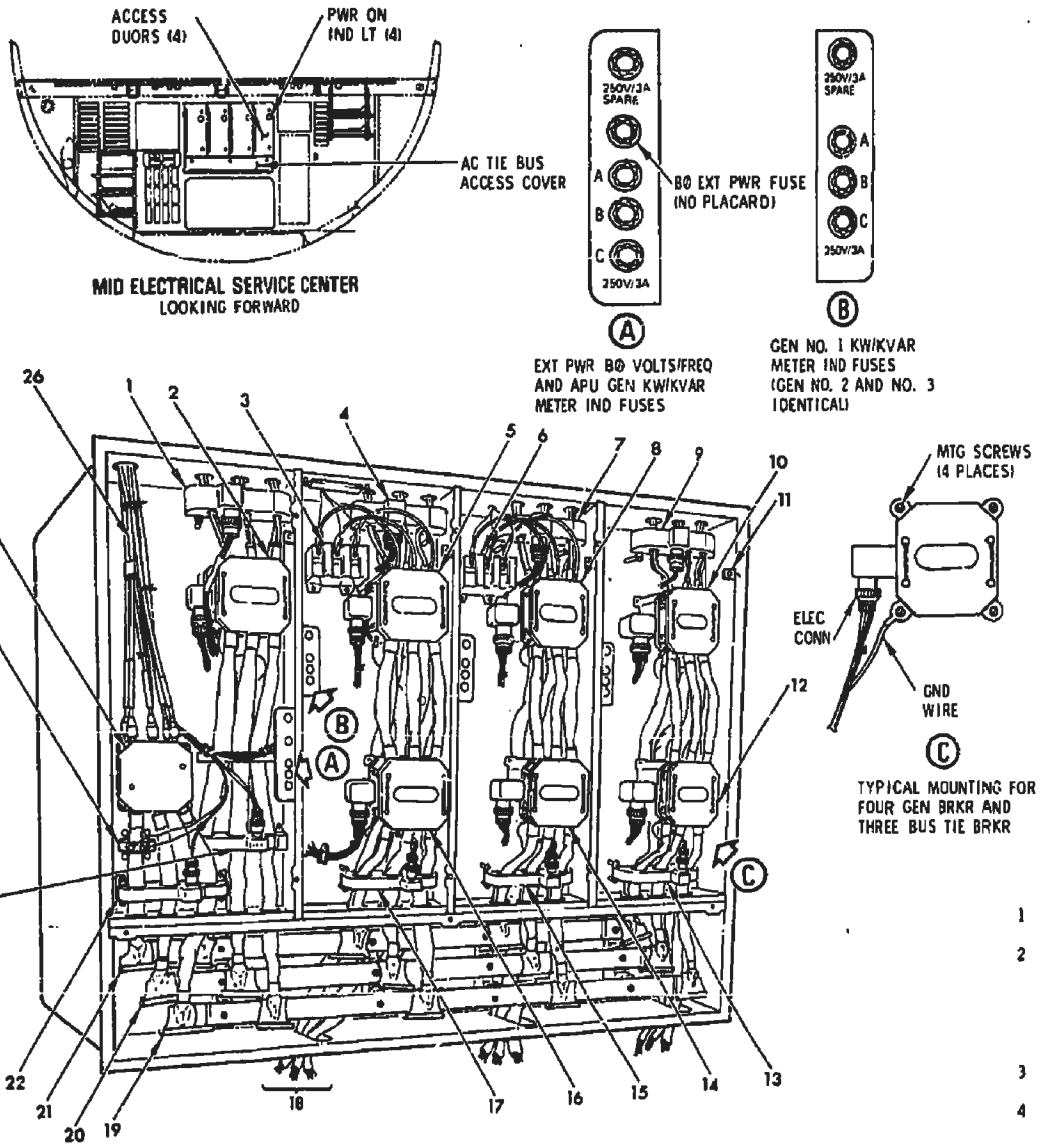
WARNING: BEFORE APPLYING EXTERNAL POWER ENSURE THAT ALL CONCERNED ARE NOTIFIED. HIGH VOLTAGES CAN BE FATAL.

R (10) Turn on external power source (Ref. 24-41-00).

(11) Remove tags from FUEL AND IGNITION switches (pilots center console), and EXT PWR switch (Flight Engineer/Second Officers electrical control panel).

(12) Remove tags and close circuit breakers opened in Step 2A(1).

R (13) Perform the following checkout procedures to determine
R that external power relay functions properly. Controls



AC POWER SYSTEM DISTRIBUTION BOX COMPONENTS

ITEM NO.	NOMENCLATURE
1	APU GENERATOR CONTROL CURRENT TRANSFORMER
2	APU GENERATOR BREAKER
3	NO. 1 GENERATOR - AC ESSENTIAL BUS POWER RCCB
4	NO. 1 GENERATOR CONTROL CURRENT TRANSFORMER
5	NO. 1 GENERATOR BREAKER
6	NO. 2 GENERATOR - AC ESSENTIAL BUS POWER RCCB
7	NO. 2 GENERATOR CONTROL CURRENT TRANSFORMER
8	NO. 2 GENERATOR BREAKER
9	NO. 3 GENERATOR CONTROL CURRENT TRANSFORMER
10	NO. 3 GENERATOR BREAKER
11	POWER ON INDICATOR LIGHT (VISIBLE WITH DOOR CLOSED). TYPICAL FOR EACH OF THE FOUR POWER DISTRIBUTION PANELS
12	NO. 3 GENERATOR BUS TIE BREAKER
13	NO. 3 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
14	NO. 2 GENERATOR BUS TIE BREAKER
15	NO. 2 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
16	NO. 1 GENERATOR BUS TIE BREAKER
17	NO. 1 GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
18	3Ø FEEDER WIRES TO AC BUS NO. 1. TYPICAL OF FEEDER WIRES TO AC BUS NO. 2 AND AC BUS NO. 3 FROM RESPECTIVE GENERATOR BREAKER
19	AC TIE BUS - CØ BUS
20	AC TIE BUS - BØ BUS
21	AC TIE BUS - AØ BUS
22	EXTERNAL POWER DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
23	APU GENERATOR DIFFERENTIAL PROTECTION CURRENT TRANSFORMER
24	EXTERNAL POWER OVERCURRENT CURRENT TRANSFORMER - AØ
25	EXTERNAL POWER RELAY
26	EXTERNAL POWER FEEDER WIRES

WARNING

DEENERGIZE ALL GENERATORS AND DISCONNECT EXTERNAL POWER AS OUTLINED IN SECTION 24-00-00 PRIOR TO PERFORMING ANY REMOVAL/INSTALLATION PROCEDURES IN THE AC DISTRIBUTION BOX OR AC TIE BUS COMPARTMENT

NOTE

1. AC POWER DISTRIBUTION BOX DOORS AND AC TIE BUS COVER PANEL NOT SHOWN
2. POWER DISTRIBUTION PANELS ARE IDENTIFIED FROM LEFT TO RIGHT AS FOLLOWS:
   A. EXTERNAL POWER AND APU GENERATOR PANEL
   B. GENERATOR NO. 1 PANEL
   C. GENERATOR NO. 2 PANEL
   D. GENERATOR NO. 3 PANEL
3. BUS TIE BREAKERS REQUIRE MICARTA SPACERS TO ACCOMMODATE FLAT BUS FEEDERS
4. INSTALL SAFETY WIRE ON ALL BREAKER COVER SCREWS

G1139
M1-01D1-24-224

External Power Relay - Removal and Installation
Figure 401

R and indicators are located on Flight Engineer/Second Officers electrical control panel (Ref. Fig. 402):

R (a) Check that AVAIL portion of EXT PWR ON/AVAIL indicator light is on.

(b) Place volts-frequency selector switch in EXT POWER
R position and check for 115V (nominal) on AC VOLTS
R meter and 400 Hz (nominal) on FREQ meter.

(c) Place essential bus selector switch in AUTO NORM B3-(G1) position.

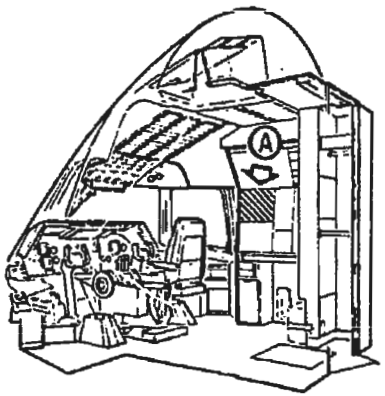
(d) Place EXT PWR switch in ON position and check that
R ON portion of EXT PWR ON/AVAIL indicator light comes on (AVAIL portion of switchlight remains on).

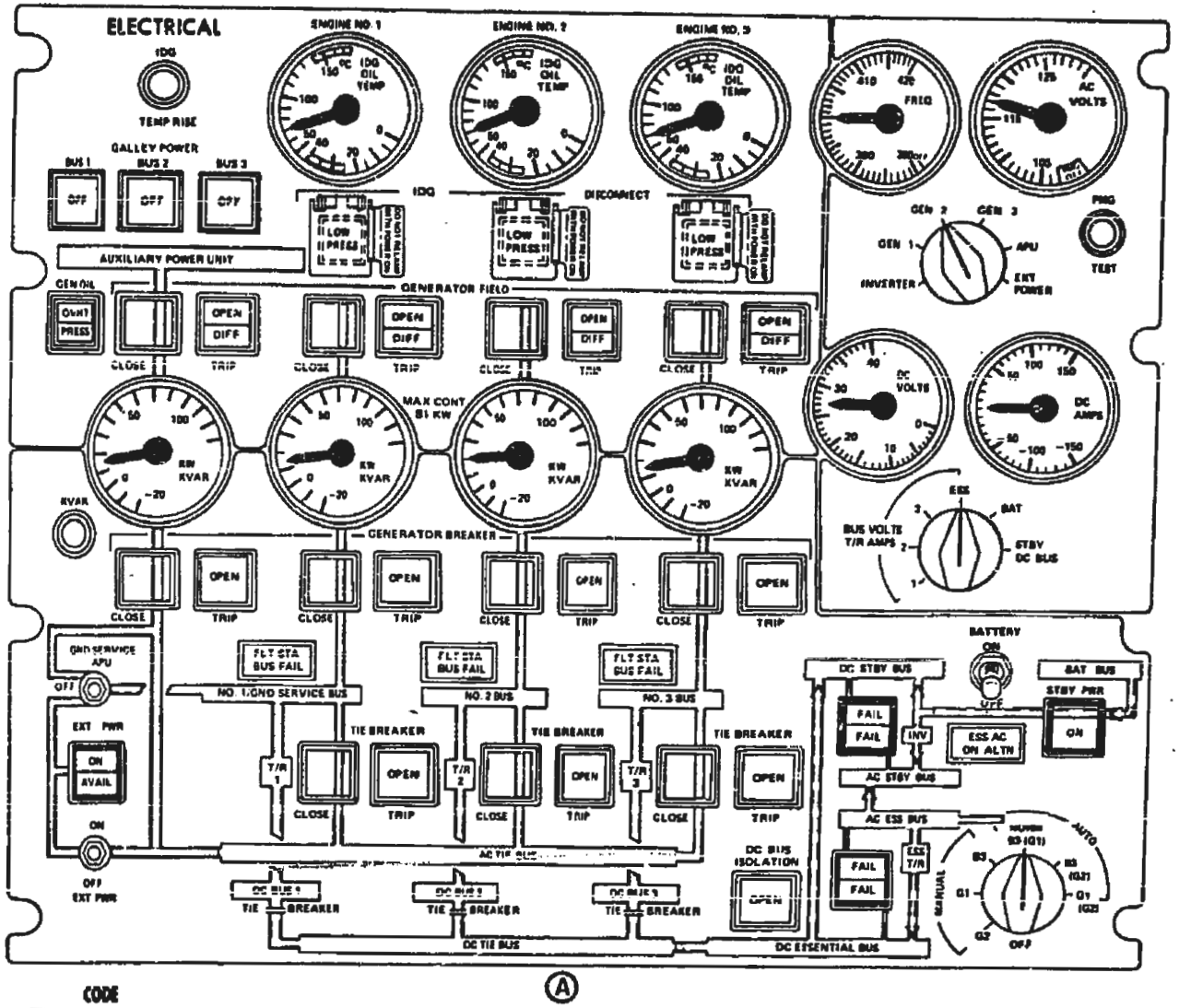
(e) Press engine No. 3 TIE BREAKER CLOSE switchlight and check for light bar to come on.

(f) Place BUS VOLTS T/R AMPS selector switch in ESS position and check for 28V (nominal) on DC VOLTS meter (DC AMPS meter reading depends on load).

(g) If external power is not needed, place EXT PWR switch in OFF position.

R (h) Turn off and disconnect external power source (Ref. 24-41-00).





M1-6000-24-098

R Flight Engineer/Second Officers Electrical Control Panel
R Figure 402

EFFECTIVITY: ALL

001B

ELECTRICAL LOAD DISTRIBUTION - DESCRIPTION AND OPERATION

1. General

Electrical power is distributed throughout the aircraft by using contactors, remotely controlled circuit breakers, buses, relays, push-pull circuit breakers, receptacles, connectors, current limiters and insulated wiring. All wiring in the electrical system is copper.

The majority of the system components are located in the mid electrical and forward electronic service centers, zones 137 and 112, respectively.

NOTE: All generator and external power feeders are color coded thus:

A-phase = red

B-phase = yellow

C-phase = blue

The generator and external power ground wires have no color code identification.

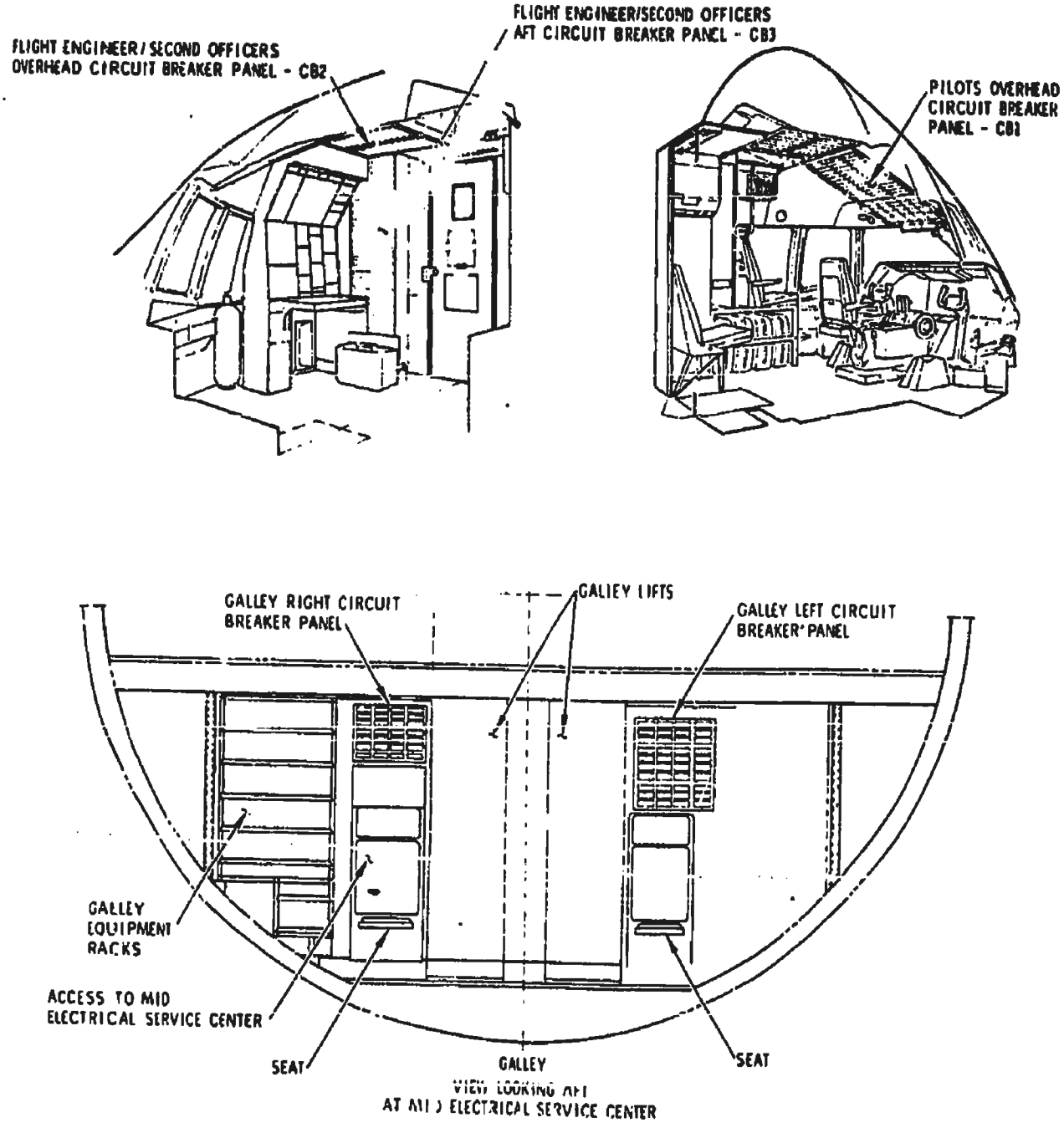
2. Circuit Breaker Panels

Circuit breaker panels (Ref. Fig. 1), are principal distribution centers located in the flight station, zone 210, the Flight Engineer/Second Officers station, zone 215, and the galley, zone 130.

R A magnetic circuit breaker panel (MCBP) is located in the MESC overhead.

Circuit breakers which are accessible to the pilots are located on the pilots overhead circuit breaker panel CB1, zone 210, (Ref. Fig. 2). Circuit breakers which are accessible to the pilots and the Flight Engineer/Second Officer are located on the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, (Ref. Fig. 3). Circuit breakers which are accessible to the Flight Engineer/Second Officer only, are located on the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, (Ref. Fig. 4).

Two circuit breaker panels are installed in the aft bulkhead of the galley, one on each side of the galley lifts. These panels are identified as galley left circuit breaker panel (Ref. Fig.

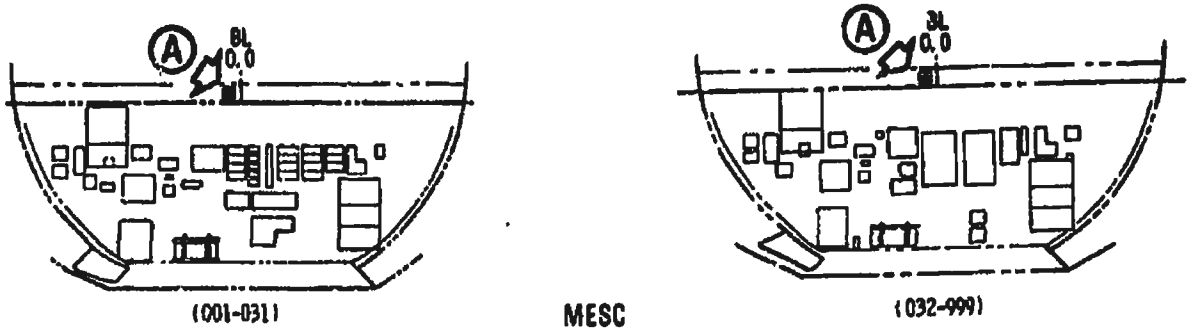


Circuit Breaker Panel Locations
Figure 1 (Sheet 1)

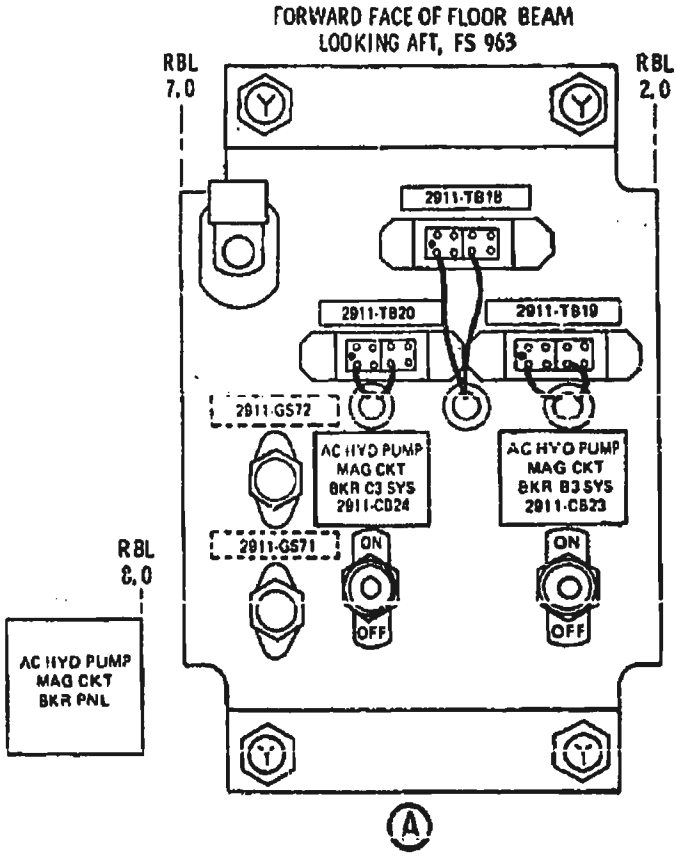
R

EFFECTIVITY: ALL

001B

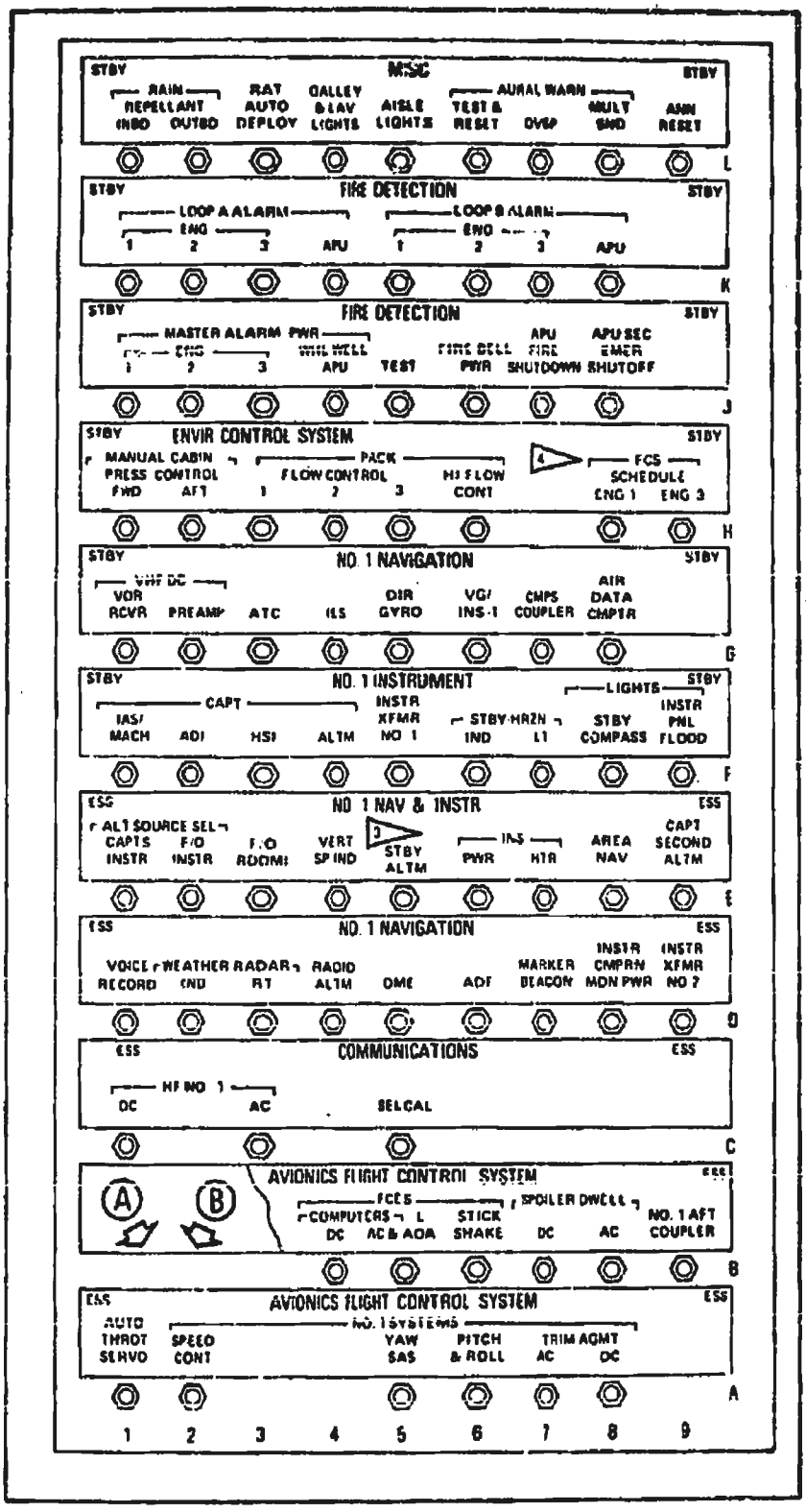


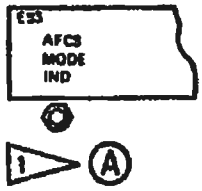
MESC
LOOKING AT AFT BULKHEAD,
FS 983

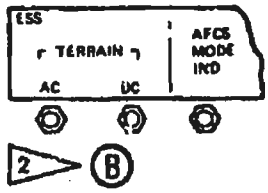


MI-0000-24-1398

Circuit Breaker Panel Locations
Figure 1 (Sheet 2)







NOTE

1 ON AIRCRAFT 001-031

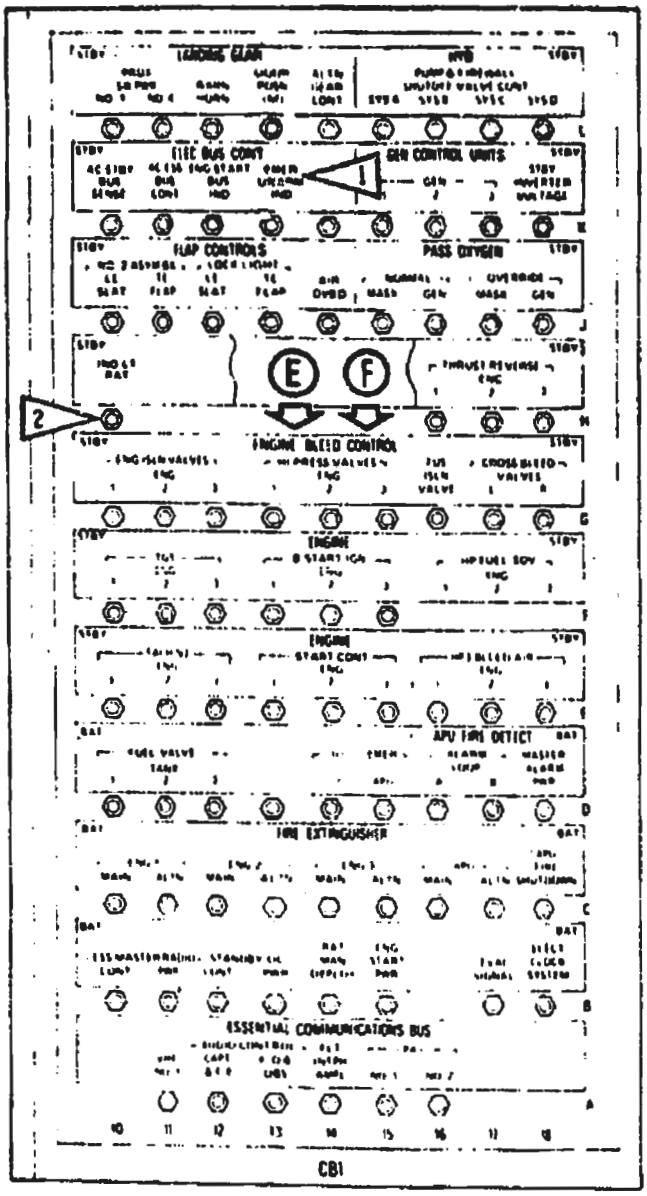
2 ON AIRCRAFT 032-999

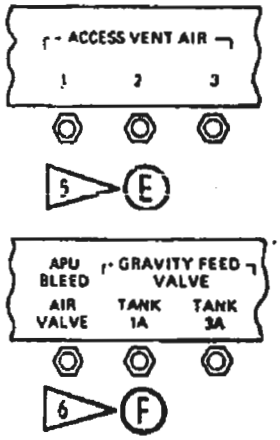
3 ON AIRCRAFT WITH SB34-062

4 ON AIRCRAFT 028, 029 WITH SB36-044

M1-0013-24-217

Pilots Overhead Circuit Breaker Panel (CB1, 1-9)
Figure 2 (Sheet 1)





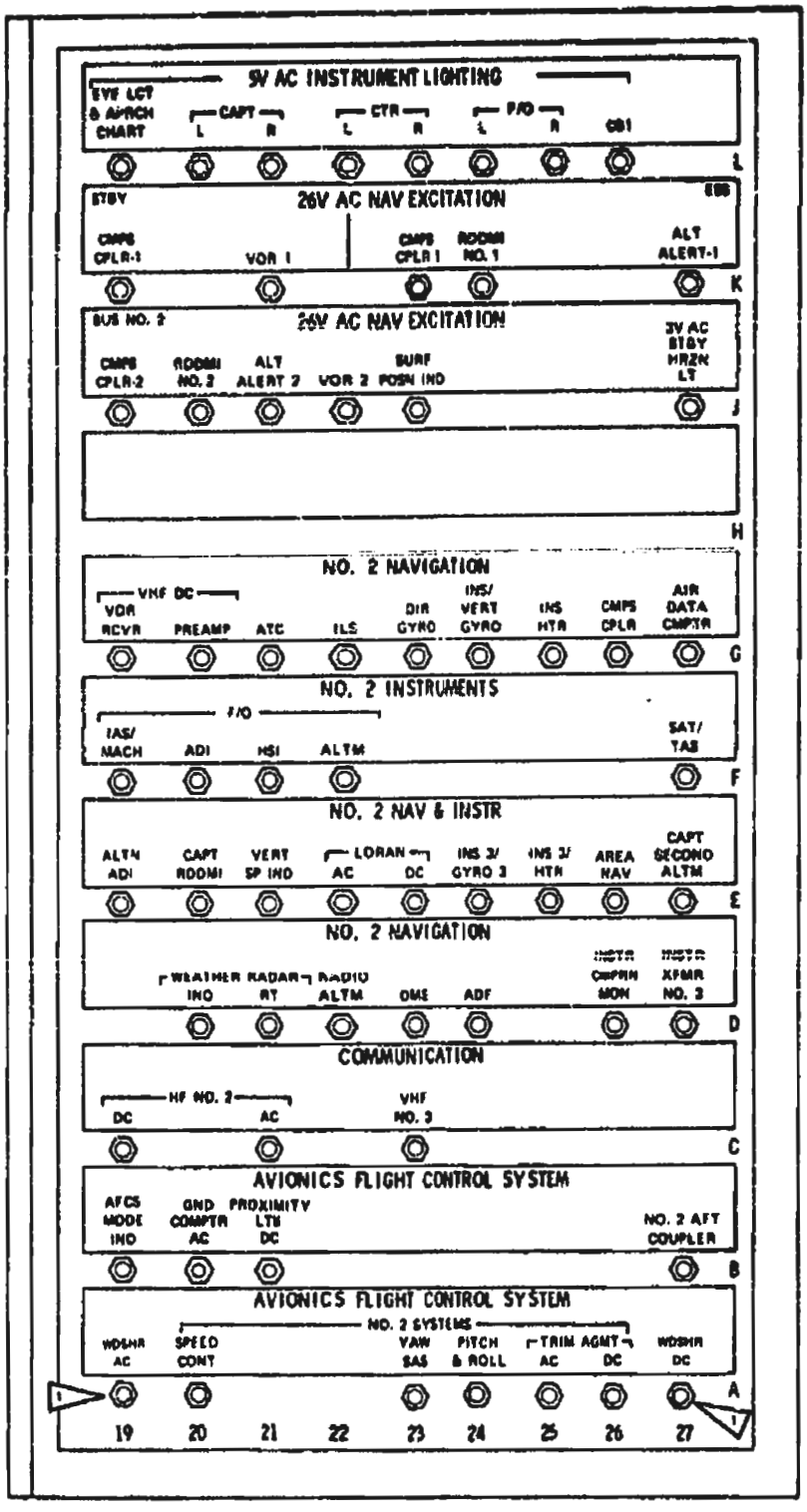
NOTE

1. NOT USED
2. INSTALLED BY MO89802
3. NOT USED
4. NOT USED
5. ON AIRCRAFT 001-035
6. ON AIRCRAFT 032-999
7. ON AIRCRAFT 001-031 WITHOUT SB33-086

M1-0004-24-668

C Pilots Overhead Circuit Breaker Panel (CB1, 10-18)
C Figure 2 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



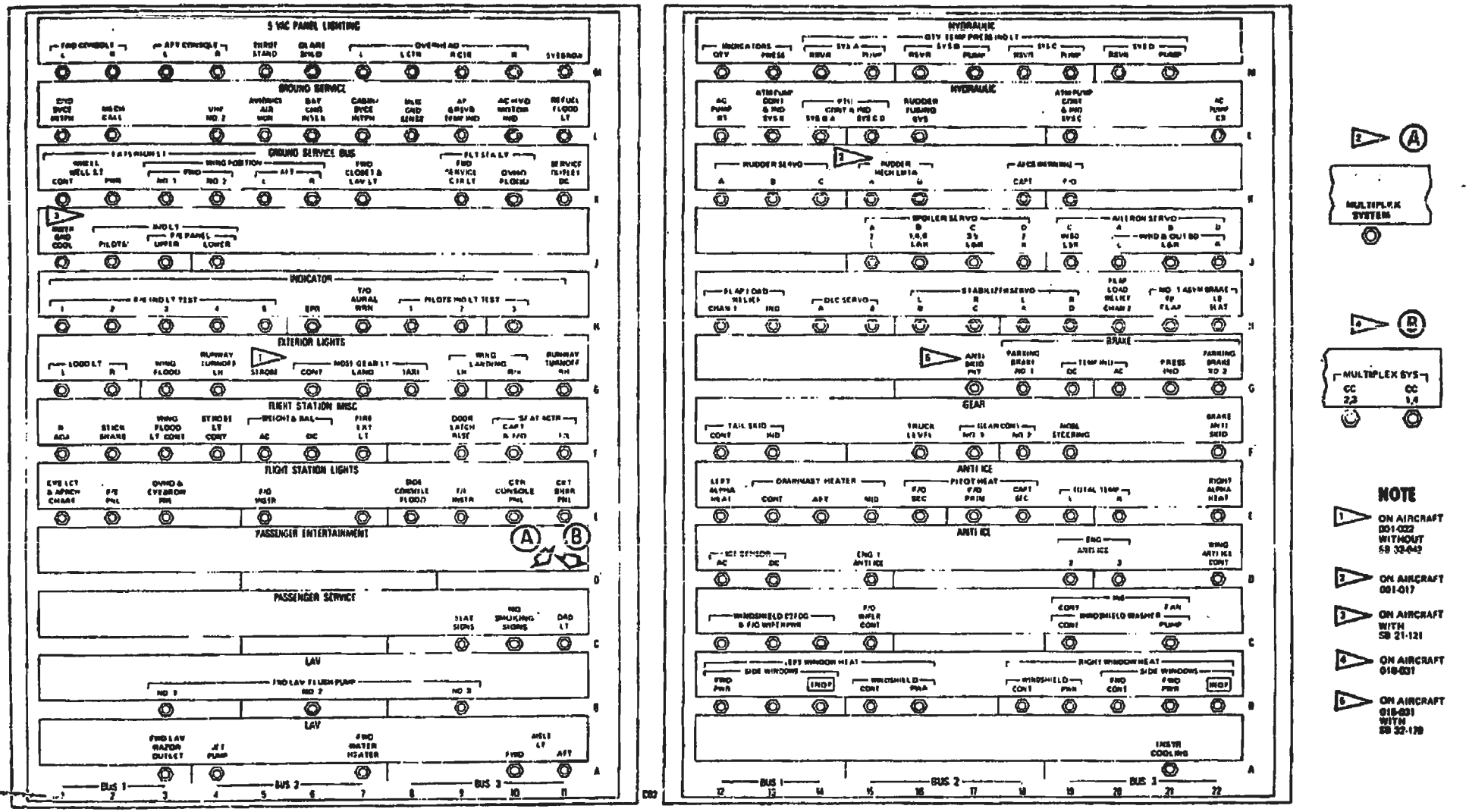
NOTE
1 AIRCRAFT WITH SB30-178

M1-0001-24-1131

R Pilots Overhead Circuit Breaker Panel (CB1, 19-27)
R Figure 2 (Sheet 3)

EFFECTIVITY: ALL

001B

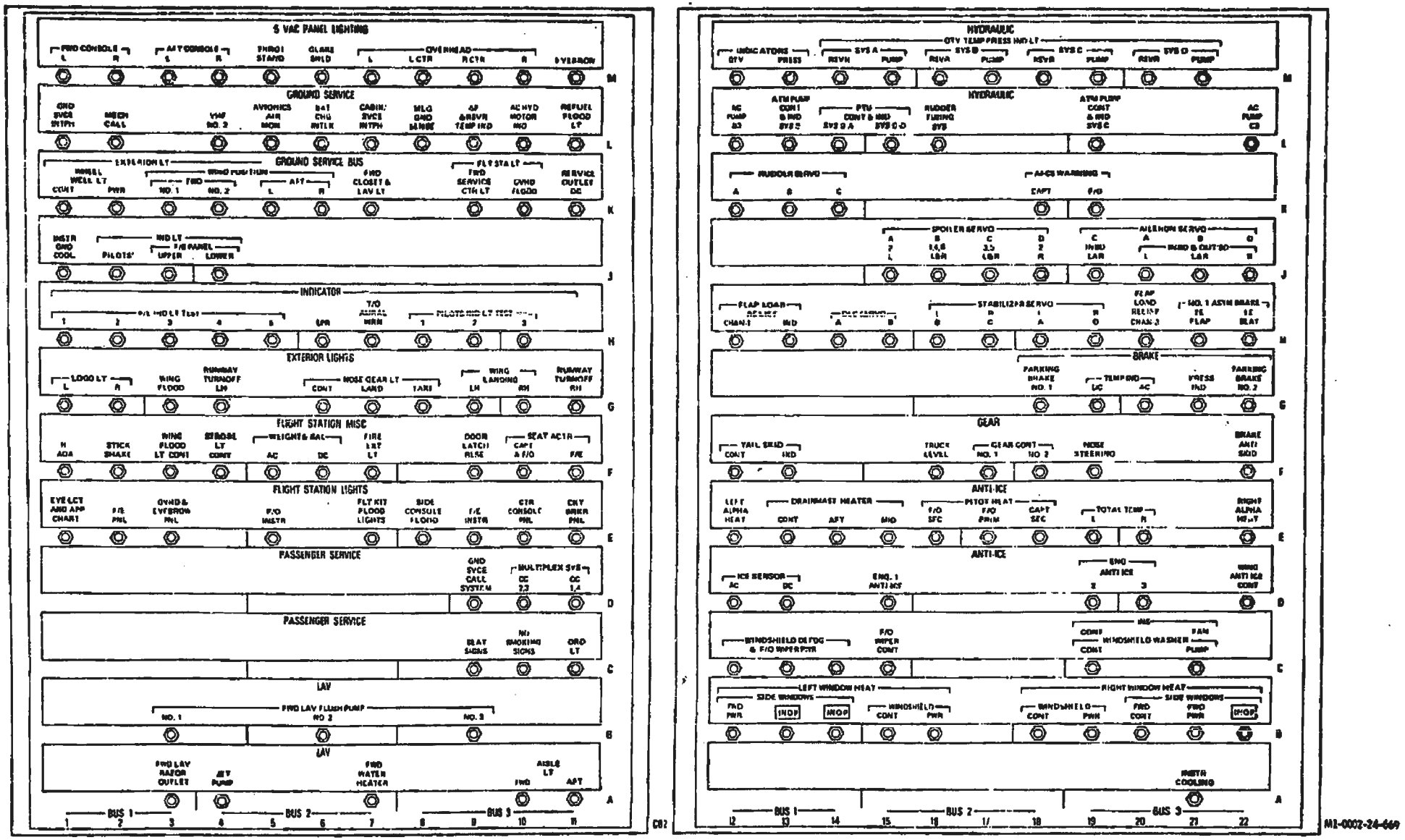


M1-0013-24-220

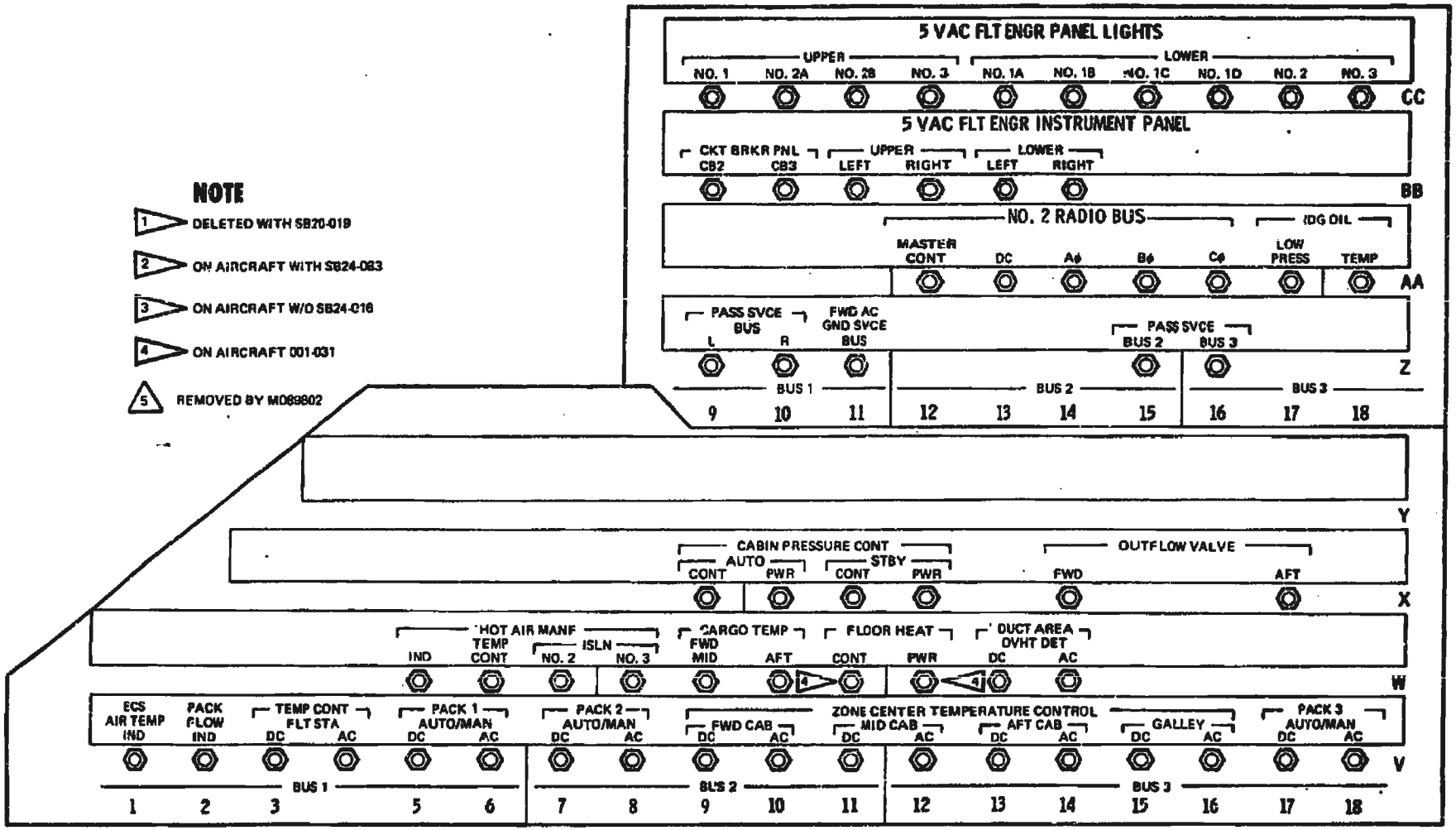
R Flight Engineer/Second Officers Overhead Circuit Breaker Panel CB
R Figure 3

EFFECTIVITY: 001-031

001B



R Flight Engineer/Second Officers Overhead Circuit Breaker Panel CB2
R Figure 3



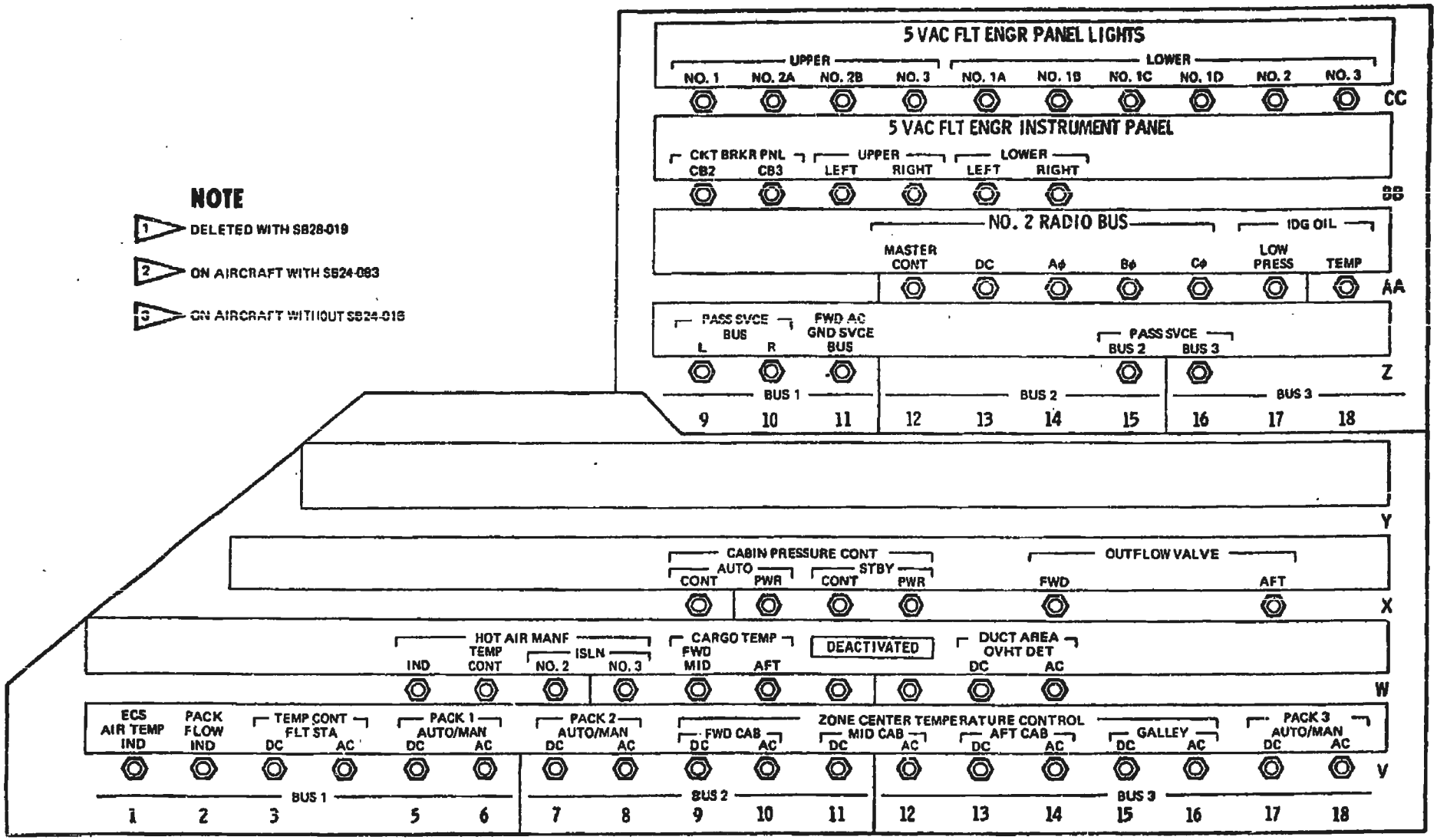
EM1-0003-24-1003

Flight Engineer/Second Officer Aft Circuit Breaker Panel CB3
Figure 4 (Sheet 1)

R EFFECTIVITY: 001-031 WITHOUT SB21-228 AND
R 032-999
001B

NOTE

1. DELETED WITH SB28-019
2. ON AIRCRAFT WITH SB24-093
3. ON AIRCRAFT WITHOUT SB24-016

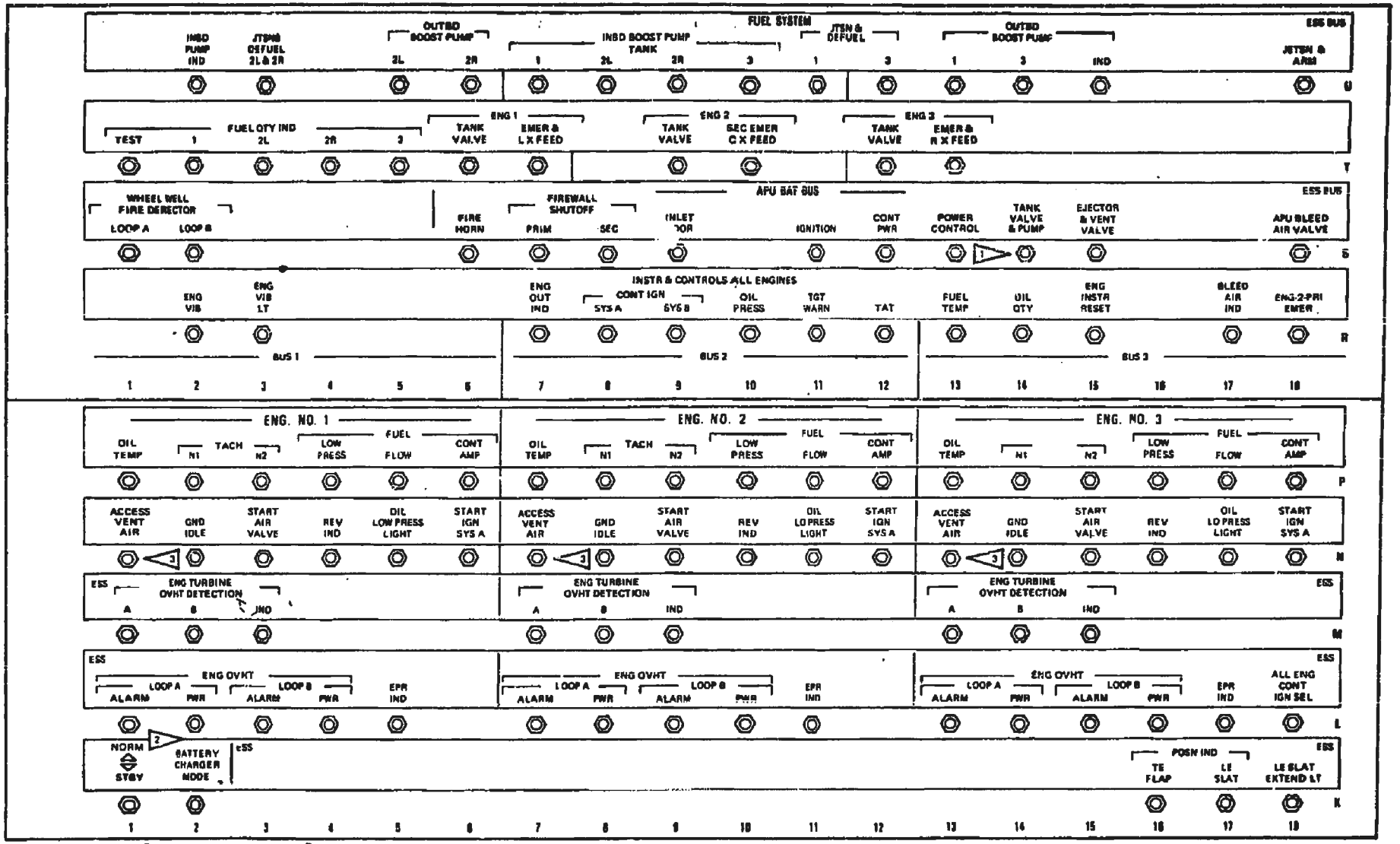


EMI-0000-24-1441

R Flight Engineer/Second Officer Aft Circuit Breaker Panel CB3
R Figure 4 (Sheet 1)

EFFECTIVITY: 001-031 WITH SB21-228

001B

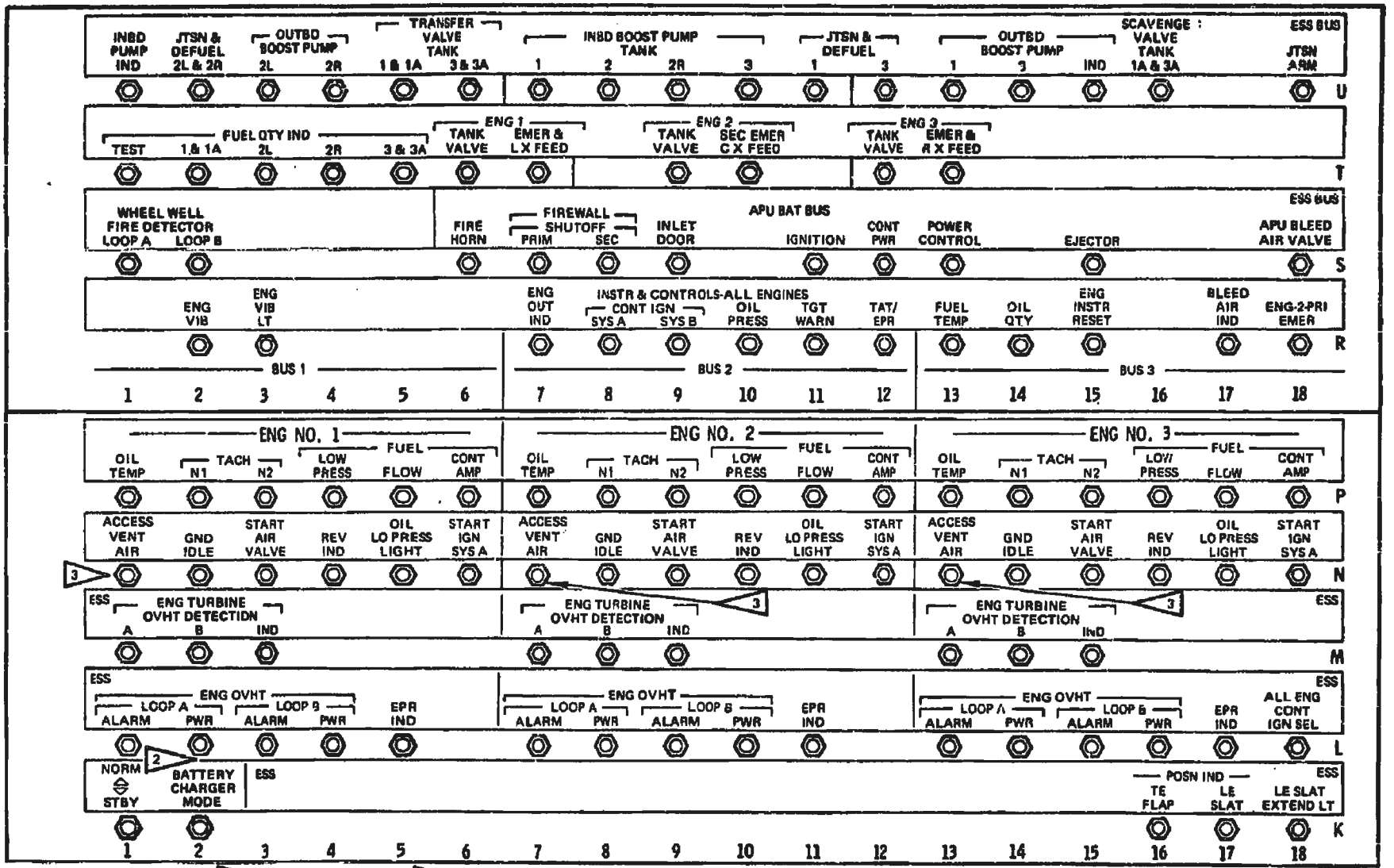


NOTE 7 WITH SB 083 24-083 3 ON AIRCRAFT W/O SB 28-016

EM1-0003-24-1028

Flight Engineer/Second Officers Aft Circuit Breaker Panel CB3
Figure 4 (Sheet 2)

R EFFECTIVITY: 001-031
R
001B

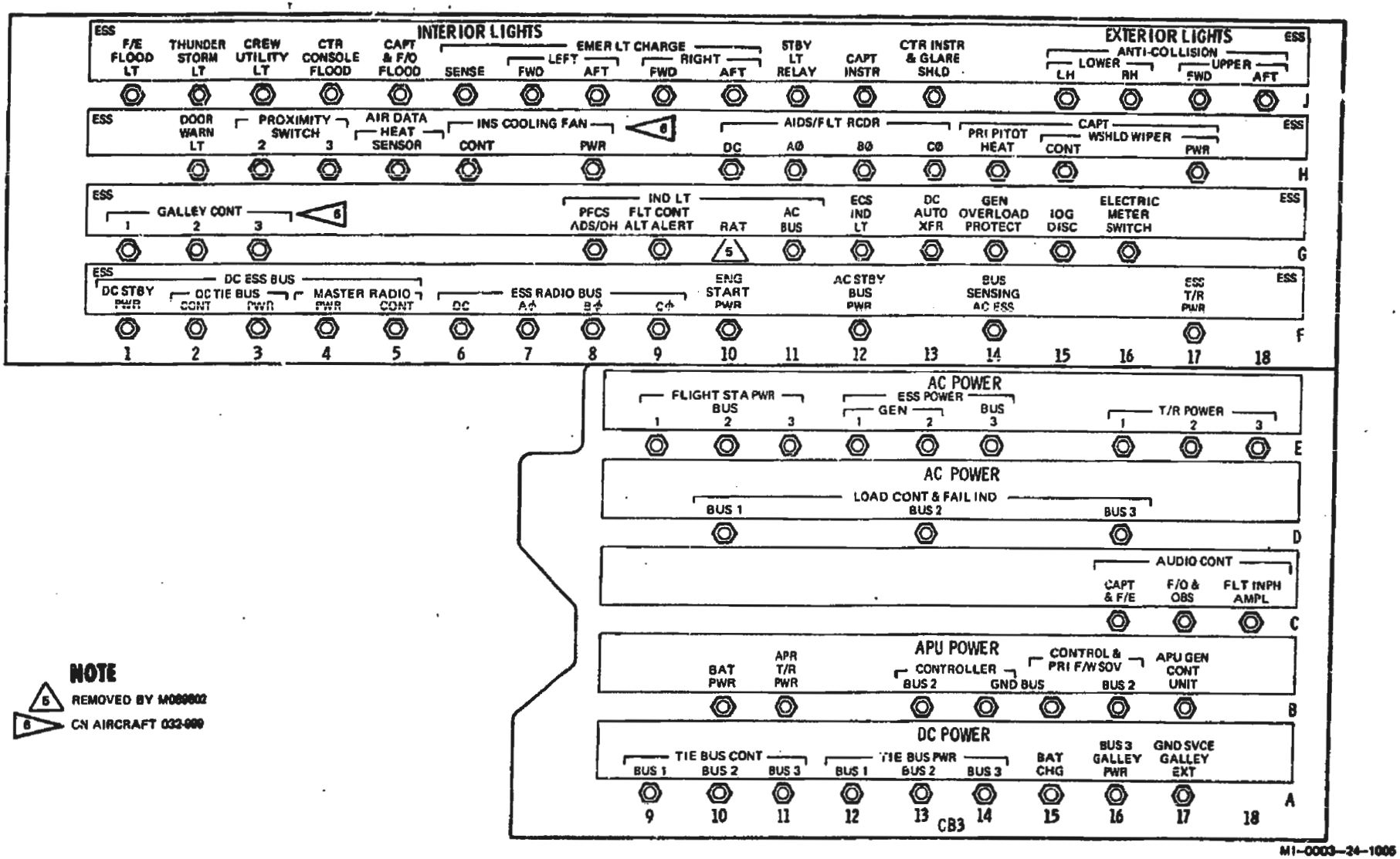

INBD PUMP IND
JTSN & DEFUEL 2L & 2R
OUTBD BOOST PUMP 2L
OUTBD BOOST PUMP 2R
TRANSFER VALVE TANK 1 & 1A
TRANSFER VALVE TANK 3 & 3A
INBD BOOST PUMP TANK 1
INBD BOOST PUMP TANK 2
INBD BOOST PUMP TANK 2R
INBD BOOST PUMP TANK 3
JTSN & DEFUEL 1
JTSN & DEFUEL 3
OUTBD BOOST PUMP 1
OUTBD BOOST PUMP 3
OUTBD BOOST PUMP IND
SCAVENGE VALVE TANK 1A & 3A
ESS BUS JTSN ARM
U
FUEL QTY IND TEST
FUEL QTY IND 1 & 1A
FUEL QTY IND 2L
FUEL QTY IND 2R
FUEL QTY IND 3 & 3A
ENG 1 TANK VALVE
ENG 1 EMER & L X FEED
ENG 2 TANK VALVE
ENG 2 SEC EMER C X FEED
ENG 3 TANK VALVE
ENG 3 EMER & R X FEED
T
WHEEL WELL FIRE DETECTOR LOOP A
WHEEL WELL FIRE DETECTOR LOOP B
FIRE HORN
FIREWALL SHUTOFF PRIM
FIREWALL SHUTOFF SEC
INLET DOOR
APU BAT BUS IGNITION
APU BAT BUS CONT PWR
APU BAT BUS POWER CONTROL
APU BAT BUS EJECTOR
ESS BUS APU BLEED AIR VALVE
S
ENG VIB
ENG VIB LT
ENG OUT IND
INSTR & CONTROLS-ALL ENGINES CONT IGN SYS A
INSTR & CONTROLS-ALL ENGINES CONT IGN SYS B
OIL PRESS
TGT WARN
TAT/ EPR
FUEL TEMP
OIL QTY
ENG INSTR RESET
BLEED AIR IND
ENG-2-PRI EMER
R
BUS 1
BUS 2
BUS 3
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
ENG NO. 1 OIL TEMP
ENG NO. 1 TACH N1
ENG NO. 1 TACH N2
ENG NO. 1 FUEL LOW PRESS
ENG NO. 1 FUEL FLOW
ENG NO. 1 FUEL CONT AMP
ENG NO. 2 OIL TEMP
ENG NO. 2 TACH N1
ENG NO. 2 TACH N2
ENG NO. 2 FUEL LOW PRESS
ENG NO. 2 FUEL FLOW
ENG NO. 2 FUEL CONT AMP
ENG NO. 3 OIL TEMP
ENG NO. 3 TACH N1
ENG NO. 3 TACH N2
ENG NO. 3 FUEL LOW PRESS
ENG NO. 3 FUEL FLOW
ENG NO. 3 FUEL CONT AMP
P
ACCESS VENT AIR
GND IDLE
START AIR VALVE
REV IND
OIL LO PRESS LIGHT
START IGN SYS A
3
N
ESS
ENG TURBINE OVHT DETECTION A
ENG TURBINE OVHT DETECTION B
ENG TURBINE OVHT DETECTION IND
M
ENG OVHT LOOP A ALARM
ENG OVHT LOOP A PWR
ENG OVHT LOOP B ALARM
ENG OVHT LOOP B PWR
EPR IND
ALL ENG CONT IGN SEL
L
NORM STBY
2
BATTERY CHARGER MODE
POSN IND TE FLAP
POSN IND LE SLAT
LE SLAT EXTEND LT
K

EFFECTIVITY 2 WITH SB 083-24-083 3 ON AIRCRAFT W/O SB 28-018

EM1-0006-24-1004

Flight Engineer/Second Officer Aft Circuit Breaker PANEL CB3
Figure 4 (Sheet 2)

R EFFECTIVITY: 032-999
R
001B



Flight Engineer/Second Officer Aft Circuit Breaker Panel CB3
Figure 4 (Sheet 3)

R
R
0018 EFFECTIVITY: ALL

5), and galley right circuit breaker panel (Ref. Fig. 6). These panels contain circuit breakers for passenger service and ground operation functions.

Various secondary circuit breaker panels are covered under their specific systems. These breakers are energized from the main circuit breaker panels and are not part of the main electrical system.

CAUTION: DO NOT RESET A CIRCUIT BREAKER WITHOUT CAREFULLY CONSIDERING ITS FUNCTION AND REFERRING TO THE APPROPRIATE FAULT ISOLATION DIAGRAM.

WHENEVER POSSIBLE, A QUICK VISUAL INSPECTION OF AFFECTED SYSTEM WIRE HARNESSES IN AREAS KNOWN TO BE SUBJECT TO WIRE CHAFING E.G. WING TRAILING EDGE, WHEEL WELLS, SPOILER ACTUATOR AREAS, HARNESSES IN CLOSE PROXIMITY TO HEAVY MAINTENANCE ACCESS PANELS, ETC. SHOULD BE MADE BEFORE RESETTING A TRIPPED CIRCUIT BREAKER.

IF A TRIPPED CIRCUIT BREAKER IS RESET AND IT IMMEDIATELY TRIPS, ANY FURTHER ATTEMPTS AT RESET CAN RESULT IN WIRE HARNESS DAMAGE.

AT THIS POINT, THE CIRCUIT BREAKER TRIP COULD BE CAUSED BY DEFECTIVE USING EQUIPMENT, A WIRING SHORT TO GROUND, OR A WIRE TO WIRE SHORT. DETAILED TROUBLESHOOTING SHOULD BE UNDERTAKEN.

3. Bus System

The ac bus system (Ref. 24-51-00) distributes 115/200 volt, 3-phase, 400-Hz power to all using systems and components, including the ac essential and standby bus system (Ref. 24-53-00). Alternating current power is distributed through a four-wire system (Ref. Fig. 7) with the aircraft structure serving as the fourth, or ground wire. Single-phase, 115 volt, 400-Hz power is available between any of the 3 phases and aircraft structure (ground).

The dc bus system (Ref. 24-52-00) distributes 28-volt power to all using systems and components, including the dc essential and standby bus system (Ref. 24-54-00). Direct current power is distributed through a two-wire system with the aircraft structure serving as the second, or ground wire. Direct current distribution centers are in the same general areas as the ac distribution points. Direct current buses (Ref. Fig. 8) are located in the distribution areas from which circuit breakers, current limiters, and fuses furnish power to, and provide circuit protection for, all using circuits.

The battery bus system (Ref. 24-55-00) distributes 26-volt (nominal) battery power to the APU battery bus and, under certain conditions, to the dc standby bus and the static inverter.

A. Ground Service Bus Distribution System

The ground service bus (Ref. Fig. 9) supplies power to selected loads from external power or from the APU generator without the necessity of energizing the complete electrical system. When in the ground service mode, the system deenergizes ac buses 2 and 3, together with certain loads on ac bus 1. Certain galley circuits, other ac loads, and dc bus 1 are also deenergized. Loads which can be energized in this mode include the following:

General cabin lights

Service outlets

Entrance lights

Maintenance lights

Lower cargo compartment lights

Wheel well lights

Accessory compartment lights

Navigation lights

Flight station dome lights

Electrically driven (auxiliary) hydraulic pump and associated indicator lights

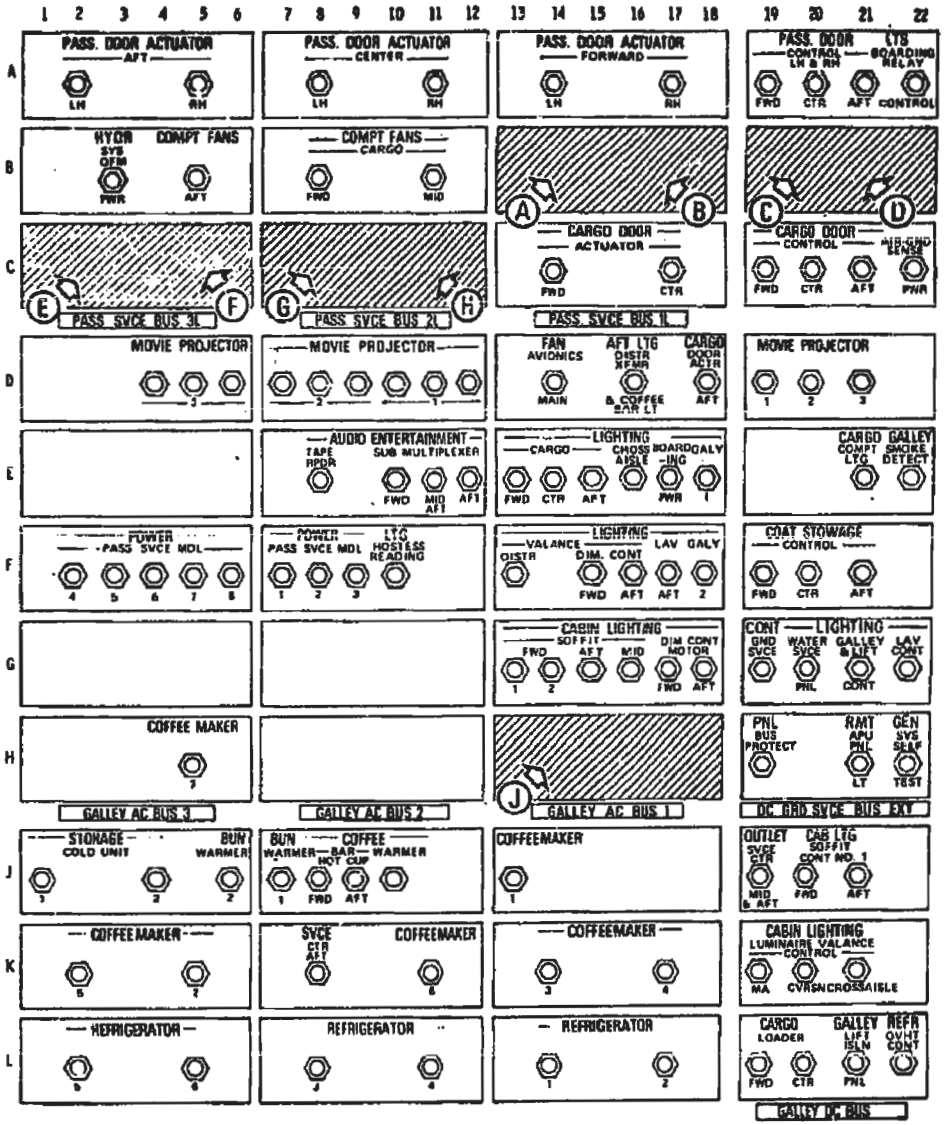
Service interphone system

Fueling controls and lights.

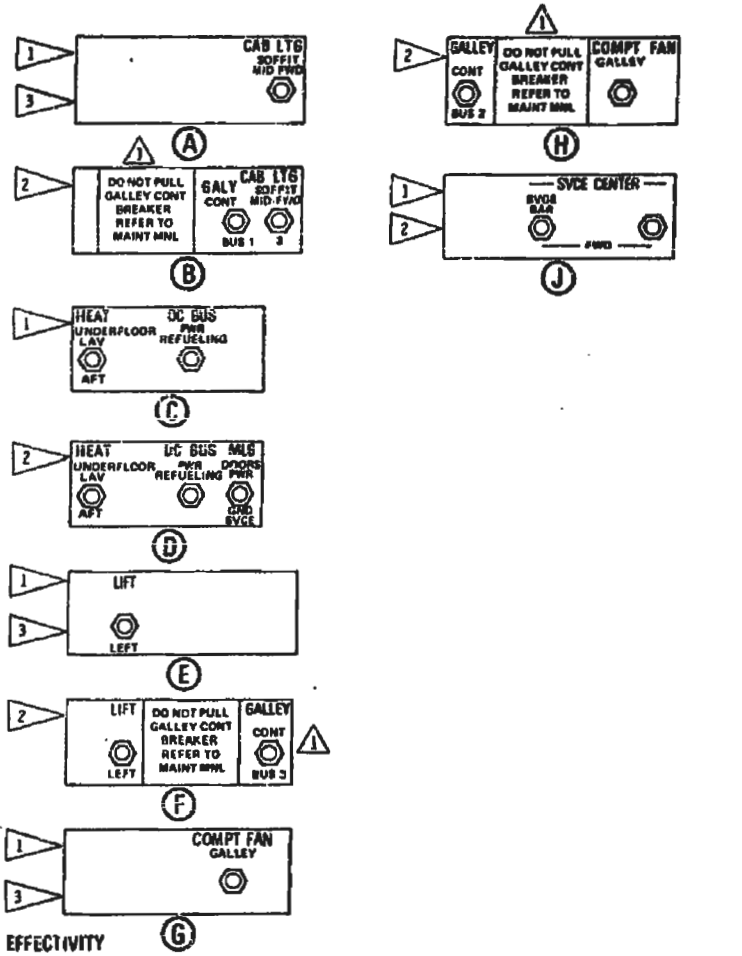
B. Standby Power Distribution System

A standby power system provides power for a minimum period of 40 minutes to operate essential loads such as instruments, navigation, communication, and lighting systems whenever power is not available from the normal sources. The system (Ref. 24-32-00), including wiring, is physically separated from the main power system.

C. External Power Feeders


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
A
PASS. DOOR ACTUATOR AFT LH RH
PASS. DOOR ACTUATOR CENTER LH RH
PASS. DOOR ACTUATOR FORWARD LH RH
PASS. DOOR CONTROL LH & RH FWD CTR AFT
LTS BOARDING RELAY CONTROL
B
HYDR SYS OFM PWR
COMPT FANS AFT
COMPT FANS CARGO FWD MID
CARGO DOOR ACTUATOR FWD CTR
CARGO DOOR CONTROL FWD CTR AFT
AIR/GND SENSE PWR
C
PASS SVCE BUS 3L
PASS SVCE BUS 2L
PASS SVCE BUS 1L
D
MOVIE PROJECTOR
FAN AVIONICS MAIN
AFT LTG DISTR XFMR & COFFEE BAR LT
CARGO DOOR ACTR AFT
E
AUDIO ENTERTAINMENT TAPE RDR SUB MULTIPLEXER FWD MID AFT
LIGHTING CARGO FWD CTR AFT CROSS AISLE BOARDING PWR GALY 1
CARGO GALLEY COMPT LTG SMOKE DETECT
F
POWER PASS SVCE MDL 4 5 6 7 8
POWER PASS SVCE MDL 1 2 3
LTG HOSTESS READING
LIGHTING VALANCE DISTR DIM. CONT FWD AFT LAV AFT GALY 2
COAT STOWAGE CONTROL FWD CTR AFT
G
CABIN LIGHTING SOFFIT FWD AFT MID DIM CONT MOTOR FWD AFT 1 2
CONT LIGHTING GND SVCE WATER SVCE PNL GALLEY & LIFT CONT LAV CONT
H
COFFEE MAKER 3
PNL BUS PROTECT
RMT APU PNL LT
GEN SYS SELF TEST
GALLEY AC BUS 3
GALLEY AC BUS 2
GALLEY AC BUS 1
DC GND SVCE BUS EXT
J
STOWAGE COLD UNIT 1 2
BUN WARMER 2
BUN WARMER 1
COFFEE BAR HOT CUP WARMER FWD AFT
COFFEEMAKER 1
OUTLET SVCE CTR MID & AFT
CAB LTG SOFFIT CONT NO. 1 FWD AFT
K
COFFEEMAKER 5 7
SVCE CTR AFT
COFFEEMAKER 6
COFFEEMAKER 3 4
CABIN LIGHTING LUMINAIRE VALANCE CONTROL MA CVR/CROSSAISLE
L
REFRIGERATOR 5 8
REFRIGERATOR 3 4
REFRIGERATOR 1 2
CARGO LOADER FWD CTR
GALLEY LIFT ISLN PNL
REFR OVHT CONT
GALLEY DC BUS

Galley Left Circuit Breaker Panel
Figure 5


1 3 CAB LTG SOFFIT MID FWD
A
2 DO NOT PULL GALLEY CONT BREAKER REFER TO MAINT MNL GALY CONT BUS 1 CAB LTG SOFFIT MID FWD 3
B
1 HEAT UNDERFLOOR LAV AFT DC BUS PWR REFUELING
C
2 HEAT UNDERFLOOR LAV AFT DC BUS PWR REFUELING MLG DOORS PWR GND SVCE
D
1 3 LIFT LEFT
E
2 LIFT LEFT DO NOT PULL GALLEY CONT BREAKER REFER TO MAINT MNL GALLEY CONT BUS 3
F
1 3 COMPT FAN GALLEY
G
2 GALLEY CONT BUS 2 DO NOT PULL GALLEY CONT BREAKER REFER TO MAINT MNL COMPT FAN GALLEY
H
1 2 SVCE CENTER RVDR BAR FWD
J

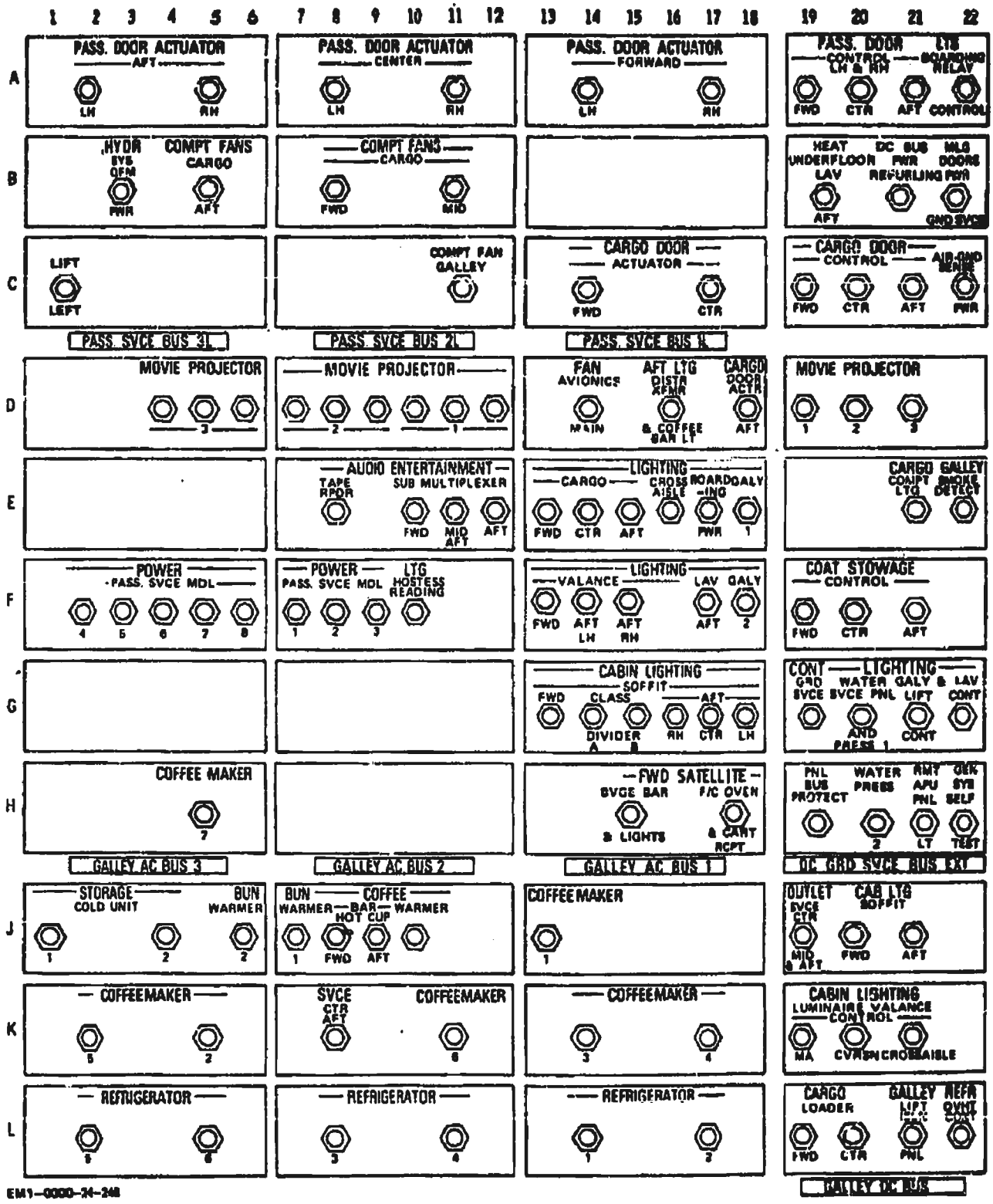
EFFECTIVITY

1 001 ONLY
2 002-029
3 030-031

NOTE

1 FOR OPERATION OF GALLEY CONT BREAKERS REFER TO MM 24-51-00

EM1-0011-24-146


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
A
PASS. DOOR ACTUATOR AFT LH RH
PASS. DOOR ACTUATOR CENTER LH RH
PASS. DOOR ACTUATOR FORWARD LH RH
PASS. DOOR CONTROL LH & RH FWD CTR AFT
LTS BOARDING RELAY CONTROL
B
HYDR SYS DEM PWR
COMPT FANS CARGO AFT
COMPT FANS CARGO FWD MID
HEAT UNDERFLOOR LAV AFT
DC BUS PWR REFURBING PWR GND SVCE
MLG DOORS PWR
C
LIFT LEFT
COMPT FAN GALLEY
CARGO DOOR ACTUATOR FWD CTR
CARGO DOOR CONTROL FWD CTR AFT
AIR GND SENSE PWR
PASS SVCE BUS 3L
PASS SVCE BUS 2L
PASS SVCE BUS 1L
D
MOVIE PROJECTOR 3
MOVIE PROJECTOR 2 1
FAN AVIONICS MAIN
AFT LTG DISTR XFMR & COFFEE BAR LT
CARGO DOOR ACTR AFT
MOVIE PROJECTOR 1 2 3
E
AUDIO ENTERTAINMENT TAPE RDR SUB MULTIPLEXER FWD MID AFT
LIGHTING CARGO FWD CTR AFT CROSS AISLE BOARDING PWR GALY 1
CARGO GALLEY COMPT LTG SMOKE DETECT
F
POWER PASS. SVCE MDL 4 5 6 7 8
POWER PASS. SVCE MDL 1 2 3
LTG HOSTESS READING
LIGHTING VALANCE FWD AFT LH AFT RH LAV AFT GALY 2
COAT STOWAGE CONTROL FWD CTR AFT
G
CABIN LIGHTING SOFFIT FWD CLASS DIVIDER A B AFT RH CTR LH
CONT LIGHTING GND SVCE WATER SVCE GALY & PNL LIFT LAV CONT AND PRESS 1 CONT
H
COFFEE MAKER 7
FWD SATELLITE SVCE BAR & LIGHTS F/C OVEN & CAPT RCPT
PNL BUS PROTECT WATER PRESS APU PNL 2 GEN SYS SELF LT TEST
GALLEY AC BUS 3
GALLEY AC BUS 2
GALLEY AC BUS 1
DC GRD SVCE BUS EXT
J
STORAGE COLD UNIT 1 2
BUN WARMER 2
BUN WARMER 1
COFFEE BAR HOT CUP FWD AFT WARMER
COFFEEMAKER 1
OUTLET SVCE CTR MID & AFT
CAB LTG SOFFIT FWD AFT
K
COFFEEMAKER 5 2
SVCE CTR AFT
COFFEEMAKER 6
COFFEEMAKER 3 4
CABIN LIGHTING LUMINAIRE CONTROL VALANCE MA CROSSAISLE
L
REFRIGERATOR 5 6
REFRIGERATOR 3 4
REFRIGERATOR 1 2
CARGO LOADER FWD CTR
GALLEY PNL
GALLEY DC BUS
EM1-0000-24-248

Galley Left Circuit Breaker Panel
Figure 5

Six copper external power feeder cables (two per phase) and one copper ground wire are attached to the external power receptacle. From pin N of the receptacle, the ground wire attaches to adjacent primary structure to provide a ground return path for the external power system. Two copper wires from each of the receptacle pins A, B, and C are routed aft from the receptacle located beneath the forward cargo compartment floor, to the external power relay in the mid electrical service center. From the external power relay, each phase is connected to the tie bus with a dual, tin-plated, flattened, insulated copper braid. This arrangement provides maximum current-carrying capacity and flexibility.

D. Generator No. 1 and No. 3 Feeders

From the generator No. 1 and No. 3 output terminals, two insulated copper wires per phase, and two insulated copper ground wires are routed in two separate bundles. Each bundle consists of one A, B, and C phase wire, and one ground wire. The wires pass through two 4-pin firewall connectors, through the pylon and inboard along the wing leading edge through a feed-through in the fire seal. In this area, the two ground wires attach to primary structure (ground).

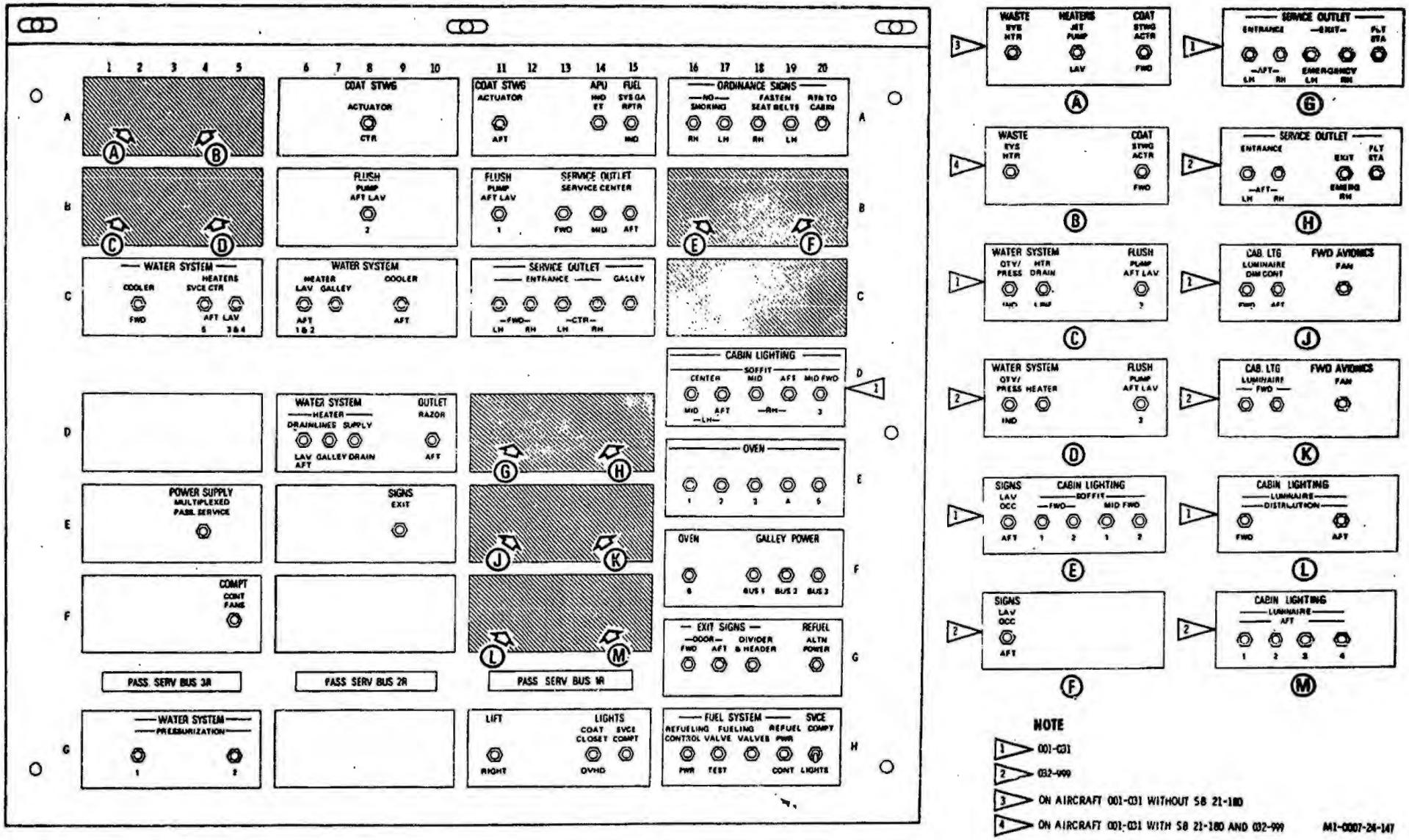
The feeders are spliced to smaller copper wires and continue inboard and forward into the mid electrical service center where they complete the circuits to their associated generator breaker.

Three-phase output from each generator breaker connects to its associated ac bus and bus tie breaker. The bus tie breaker three-phase output connects to the common ac tie bus for system paralleling. This connection consists of three dual, tin-plated, flattened, insulated copper braids which provide maximum current-carrying capacity and flexibility.

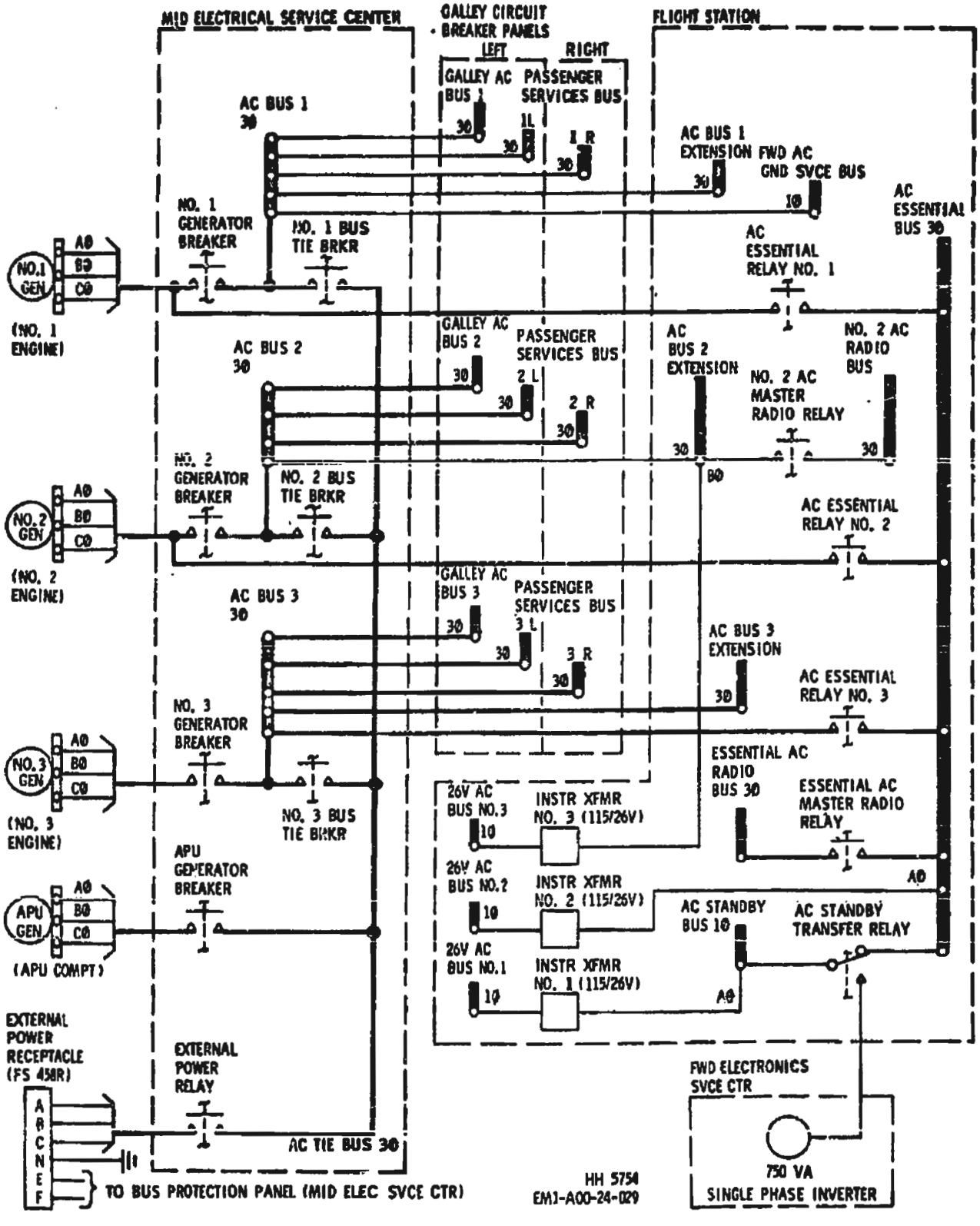
E. Generator No. 2 Feeders

From the generator No. 2 output terminals, two insulated copper wires per phase, and two insulated copper ground wires are routed in two separate bundles. Each bundle consists of one A, B, and C phase wire, and one ground wire. The bundles are routed through two 4-pin firewall connectors. The two ground wires attach to primary structure (ground) in this area. The feeders continue forward to the mid electrical service center where they connect to the No. 2 generator breaker.

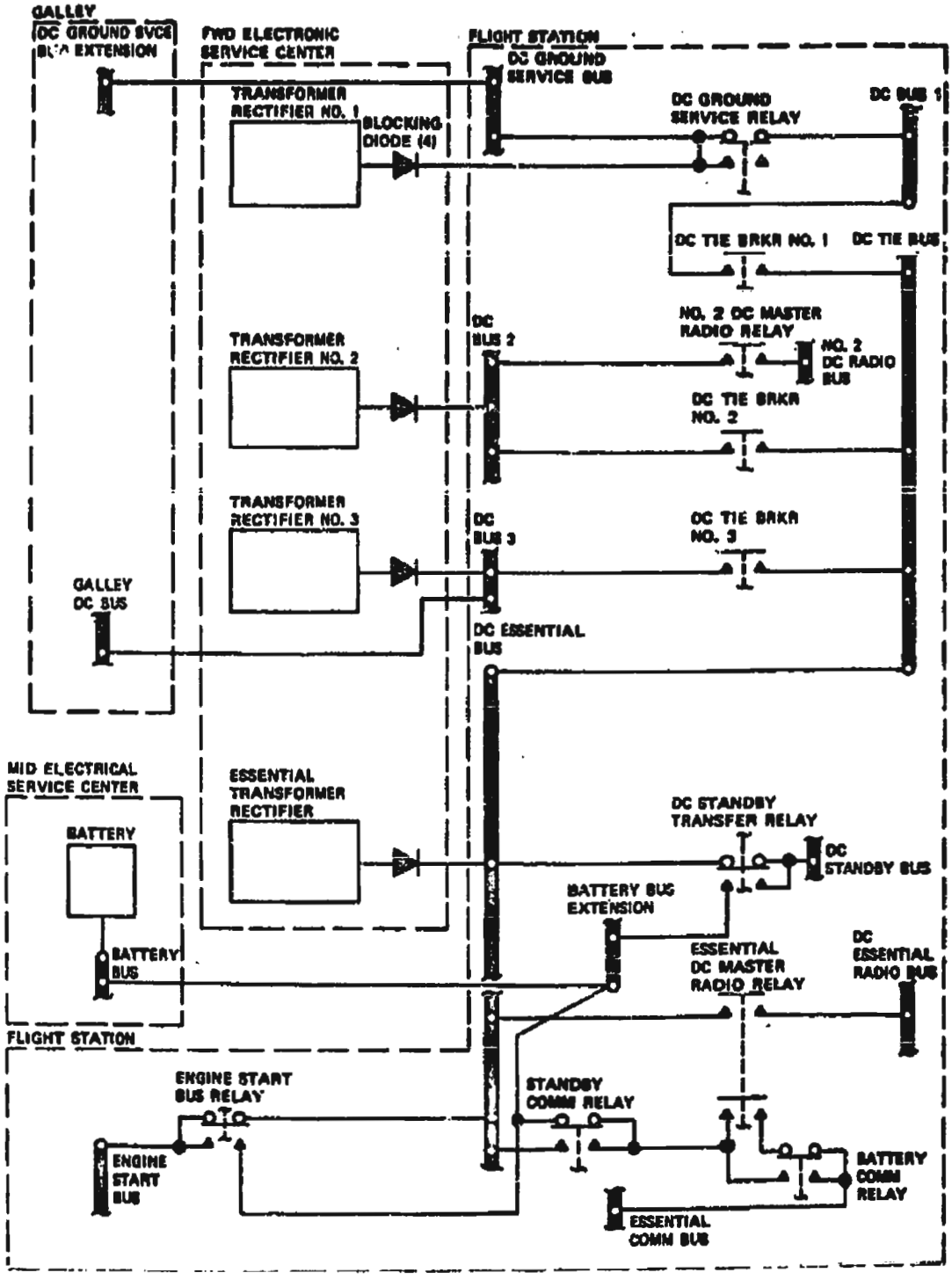
Three-phase output from the No. 2 generator breaker connects to ac bus 2 and to the No. 2 bus tie breaker. The bus tie



Galley Right Circuit Breaker Panel
Figure 6



AC Bus Distribution System Simplified Schematic
Figure 7



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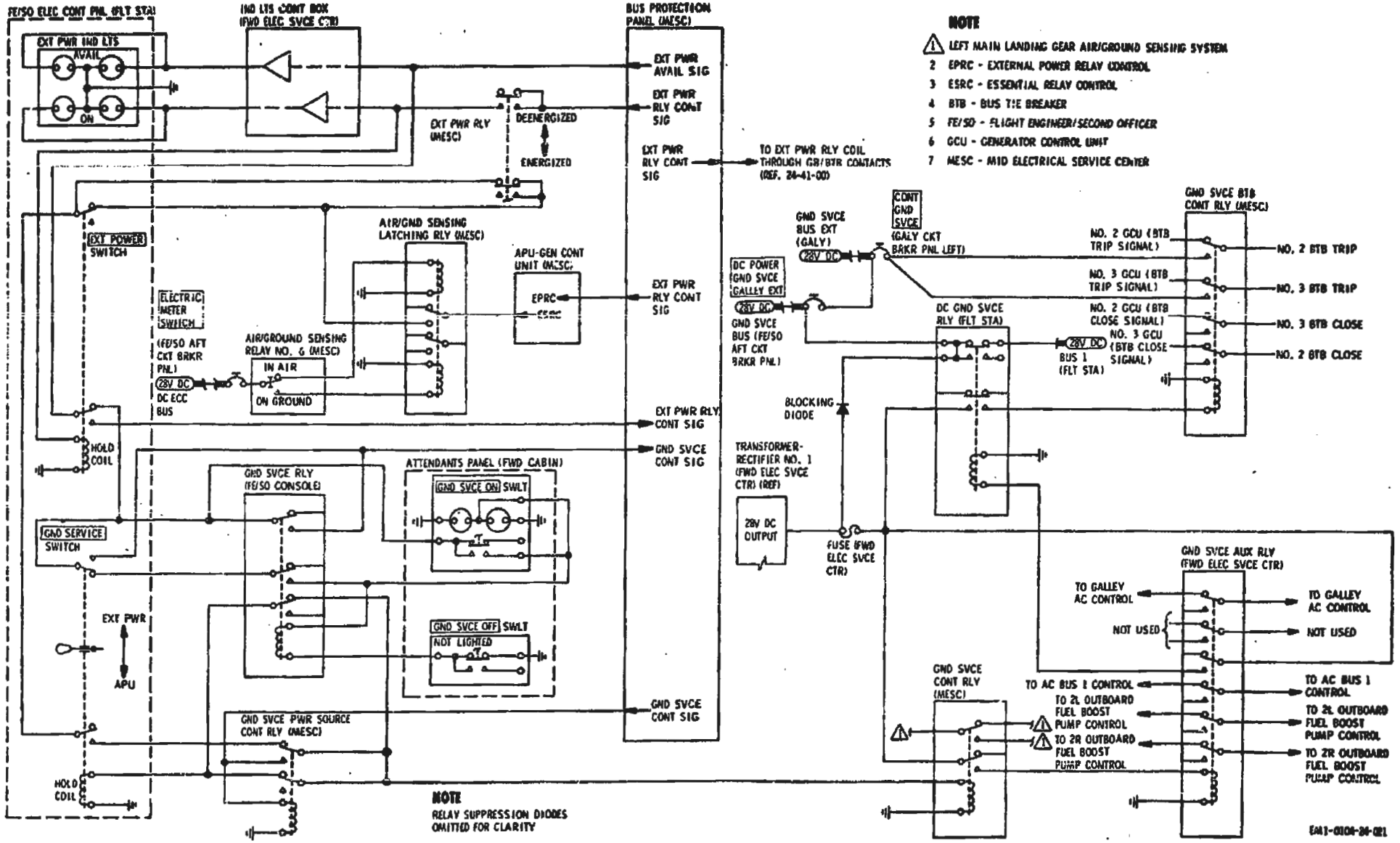
DC Bus Distribution Simplified Schematic
Figure 8


FE/SO ELEC CONT PNL (FLT STA)
EXT PWR IND LTS
AVAIL
ON
IND LTS CONT BOX (FWD ELEC SVCE CTR)
BUS PROTECTION PANEL (MESC)
EXT PWR AVAIL SIG
EXT PWR RLY CONT SIG
EXT PWR RLY (MESC)
DEENERGIZED
ENERGIZED
EXT PWR RLY CONT SIG
TO EXT PWR RLY COIL THROUGH GB/BTB CONTACTS (REF. 24-41-00)
EXT POWER SWITCH
AIR/GND SENSING LATCHING RLY (MESC)
APU-GEN CONT UNIT (MESC)
EPRC
ESRC
EXT PWR RLY CONT SIG
ELECTRIC METER SWITCH
(FE/SO AFT CKT BRKR PNL)
28V DC
DC ECC BUS
AIR/GROUND SENSING RELAY NO. 6 (MESC)
IN AIR
ON GROUND
EXT PWR RLY CONT SIG
HOLD COIL
GND SVCE CONT SIG
GND SVCE RLY (FE/SO CONSOLE)
ATTENDANTS PANEL (FWD CABIN)
GND SVCE ON SWLT
GND SERVICE SWITCH
EXT PWR
APU
GND SVCE OFF SWLT
NOT LIGHTED
GND SVCE CONT SIG
GND SVCE PWR SOURCE CONT RLY (MESC)
HOLD COIL
NOTE
RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
NOTE
1 LEFT MAIN LANDING GEAR AIR/GROUND SENSING SYSTEM
2 EPRC - EXTERNAL POWER RELAY CONTROL
3 ESRC - ESSENTIAL RELAY CONTROL
4 BTB - BUS TIE BREAKER
5 FE/SO - FLIGHT ENGINEER/SECOND OFFICER
6 GCU - GENERATOR CONTROL UNIT
7 MESC - MID ELECTRICAL SERVICE CENTER
GND SVCE BUS EXT (GALY)
28V DC
CONT GND SVCE (GALY CKT BRKR PNL LEFT)
DC POWER GND SVCE GALLEY EXT
GND SVCE BUS (FE/SO AFT CKT BRKR PNL)
DC GND SVCE RLY (FLT STA)
BUS 1 (FLT STA)
GND SVCE BTB CONT RLY (MESC)
NO. 2 GCU (BTB TRIP SIGNAL)
NO. 3 GCU (BTB TRIP SIGNAL)
NO. 2 GCU (BTB CLOSE SIGNAL)
NO. 3 GCU (BTB CLOSE SIGNAL)
NO. 2 BTB TRIP
NO. 3 BTB TRIP
NO. 3 BTB CLOSE
NO. 2 BTB CLOSE
BLOCKING DIODE
TRANSFORMER-RECTIFIER NO. 1 (FWD ELEC SVCE CTR) (REF)
28V DC OUTPUT
FUSE (FWD ELEC SVCE CTR)
GND SVCE AUX RLY (FWD ELEC SVCE CTR)
TO GALLEY AC CONTROL
NOT USED
GND SVCE CONT RLY (MESC)
TO AC BUS 1 CONTROL
TO 2L OUTBOARD FUEL BOOST PUMP CONTROL
TO 2R OUTBOARD FUEL BOOST PUMP CONTROL
EA1-0104-24-021

Ground Service Control and Distribution System Simplified Schematic
Figure 9

breaker output connects to the common ac tie bus for paralleling. This connection consists of three dual, tin-plated, flattened, insulated copper braids which provide maximum current-carrying capacity and flexibility.

F. APU Generator Feeders

From the APU generator output terminals, two insulated copper wires per phase, and two insulated ground wires are routed in two separate bundles. Each bundle consists of one A, B, and C phase wire, and one ground wire. The bundles are routed through two 4-pin firewall connectors, and forward where the two ground wires are attached to primary structure (ground). The power feeders continue forward to the mid electrical service center where they connect to the APU generator breaker.

Three-phase output from the APU generator breaker connects directly to the common ac tie bus for system paralleling. This connection consists of three dual, tin-plated, flattened, insulated copper braids which provide maximum current-carrying capacity and flexibility.

CR CR ELECTRICAL LOAD DISTRIBUTION - MAINTENANCE NOTES, DATA, TOLERANCES AND REGULATIONS

CR 1. Pull Circuit Breakers

CR A. The following circuit breakers may be pulled on layovers of six hours or more.

CR (1) Seventeen circuit breakers located on pilot's overhead panel CB-1.

CR STBY HRZN (F6)

CR CAPT ADI (F2)

CR CAPT HSI (F3)

CR CAPT RDDMI (E20)

CR F/O ADI (F20)

CR F/O HSI (F21)

CR F/O RDDMI (E3)

CR 3 - TGT (F10, F11, F12)

CR 3 - N3 TACH (E10, E11, E12)

CR OXYGEN MASK & GENERATOR (J15, J16, J17, J18)

CR (2) Fifteen circuit breakers located on FE/SO panel CB-3.

CR 3 - N1 TACH (P2, P8, P14)

CR 3 - N2 TACH (P3, P9, P15)

CR 3 - FUEL FLOW (P5, P11, P17)

CR 3 - GROUND IDLE (N2, N8, N14)

CR 3 - EPR IND (L5, L11, L17)

CR (3) Two circuit breakers located on FE/SO panel CB2:

CR FWD NBR 2 wing POSN light (K4)

CR Nose Steering (F19)

CR 2. Reset Circuit Breakers

CR A. If pulled, the above circuit breakers must be reset
CR approximately one hour before scheduled flight departure.

CR B. Insure STBY HRZN erects and flag is out of view and that
CR engine instruments appear normal with no flags after circuit
CR breakers are reset.

CR 3. Correct Torque of RCCB Terminal Lug Screw

CR A. The 8-32 titanium screws that secure system wiring to
CR terminal lugs on all RCCBs will be torqued to 20-25
CR pound-inches when they are installed. RCCBs are located in
CR battery power box, AC bus box and APU power and control
CR equipment panel.

REMOTE CONTROL CIRCUIT BREAKER - REMOVAL AND INSTALLATION

1. Equipment

Contact Removal/Insertion Tool, NAS 1664-20, or equivalent

2. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
20-24-02	Crimped Electrical Contact - Removal and Installation
24-00-00	Electrical Power - Maintenance Practices

3. Removal/Installation

WARNING: BTB SHOULD BE TRIPPED AND APPROPRIATE GEN CONTROL UNIT CIRCUIT BREAKER OPENED AND TAGGED (CB1 PNL, K15, K16, K17) WHEN WORKING ON AN AC BUS, WITH POWER SUPPLIED TO REMAINDER OF THE AIRCRAFT.

AS AN ADDITIONAL PRECAUTION THE CONNECTOR PLUG ON THE REAR OF THE BTB MAY BE REMOVED.

A. Removal

(1) On APU CONTROL panel, zone 215, place MASTER POWER switch in OFF position and tag.

R (2) On pilots center console, zone 210, place the three FUEL AND IGNITION switches in the OFF position and tag.

R (3) Turn off electrical power (Ref. 24-00-00).

R (4) Gain access to mid electrical service center (Ref. R 6-40-00).

R (5) Remove cover on panel containing RCCBs (Ref. Fig. 401).

R (6) Remove terminal insulators, tag and remove all wires R including small control and indication wires, S1, S2, R S3, 3, and 4, to ensure proper reinstallation (Ref. R Fig. 402 and 20-24-02).

R NOTE: To remove small control and indication wires, R use removal/insertion tool.

(7) To prevent incorrect installation of a single phase unit NOTE exact position of RCCB and plug-in connector, (before removal) in relation to other units.

NOTE: Mounting holes on three-phase units prevent incorrect installation.

(8) Remove base mounting screws and remove RCCB.

B. Installation

(1) Verify that switches opened in Steps 3A(1) and (2) are in off position and tagged.

(2) Verify that electrical power is off (Ref. 24-00-00).

CAUTION: REFER TO IPC FOR VERIFICATION OF CORRECT AMP RATING OF RCCB BEFORE INSTALLATION.

(3) Position RCCB as noted in Step 4A(8); place RCCB in proper position and install base mounting screws. (Mounting holes on 3-phase RCCB prevent incorrect installation.)

CAUTION: OBSERVE CORRECT PHASING ON THREE-PHASE RCCB'S WHEN INSTALLING THREE-PHASE WIRING (REF. FIGURES 401 AND 402).

C (4) Connect wires to terminals and remove tags (Ref. Fig. C 402).

C NOTE: To insert small control and indication wires C into terminals S1, S2, S3, 3, and 4 use C removal/insertion tool (Ref. 20-24-02). Torque C 8-32 terminal lug screws to 20-25 pound-inches.

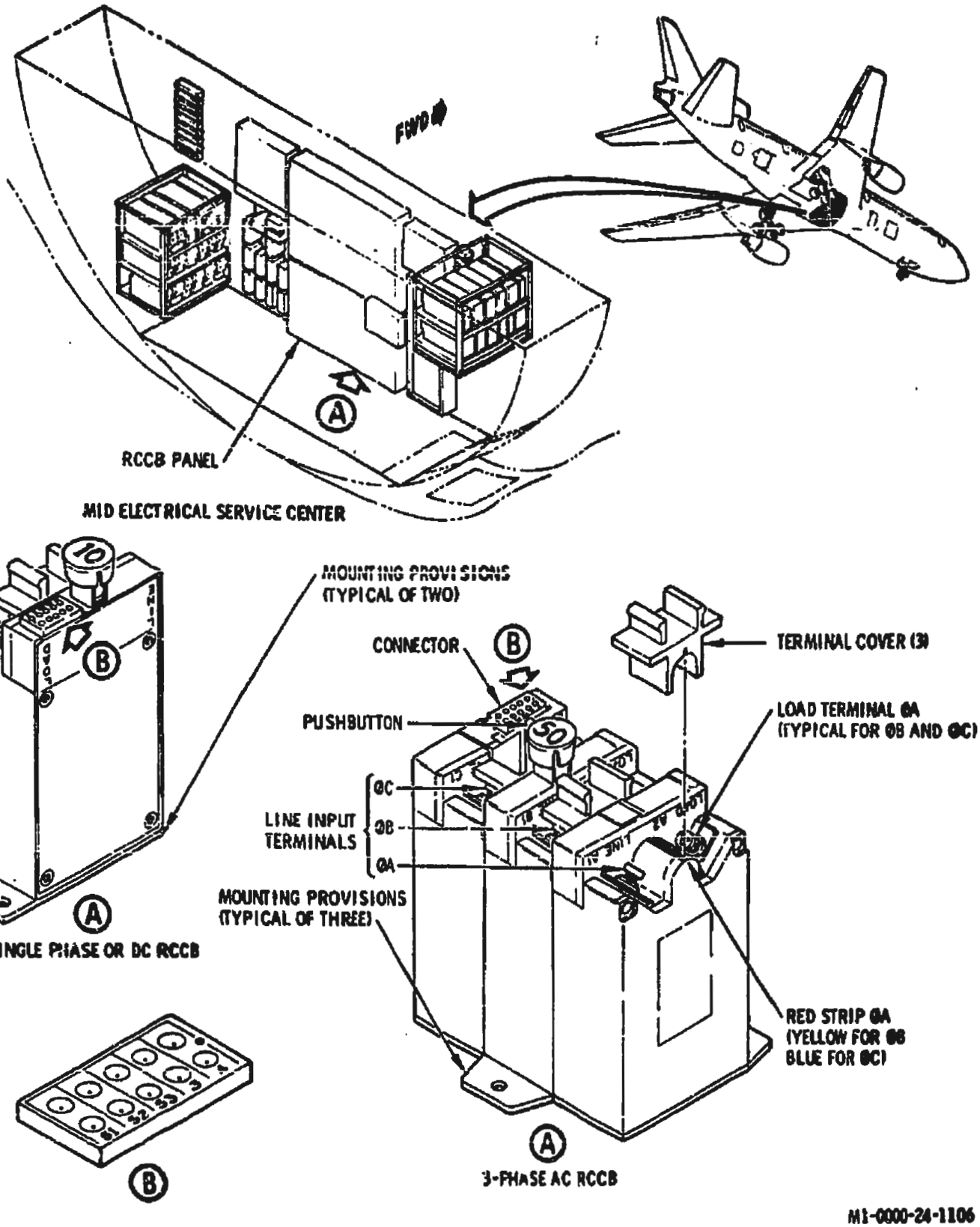
R NOTE: Torque contact screws on remote control circuit R breaker to 10-15 pound-inches or 1.12-1.67 Newton-Meter.

(5) Remove tags from switches [Ref. Steps 3A(1) and (2)].

(6) Turn on electrical power (Ref. 24-00-00).

(7) Locate trip/set circuit breaker in flight station (or galley) which controls replaced RCCB.

(8) On aircraft with LS10071( ) and or LS10072B( ) RCCB's,
open and close trip/set circuit breaker; verify RCCB opens and closes as indicated by appearance and



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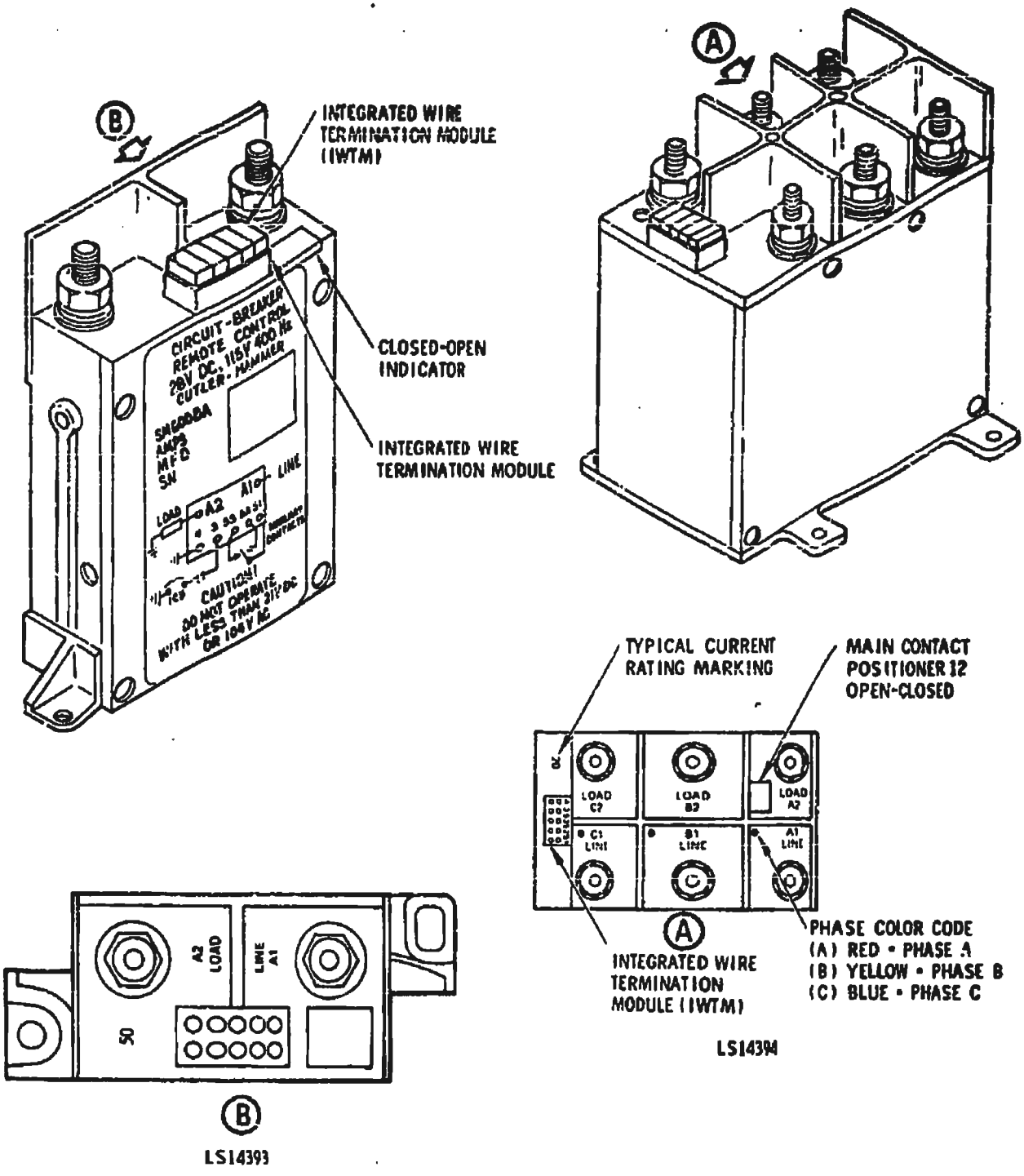
R LS10071-( ) and LS10072B( ) Remote Control
R Circuit Breaker Removal and Installation
R Figure 401

EFFECTIVITY: ALL

001B



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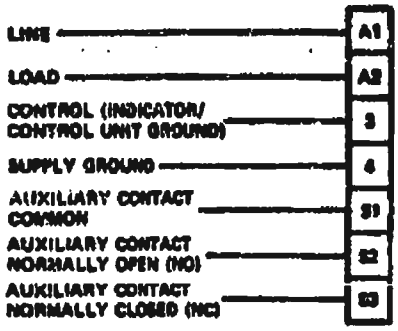
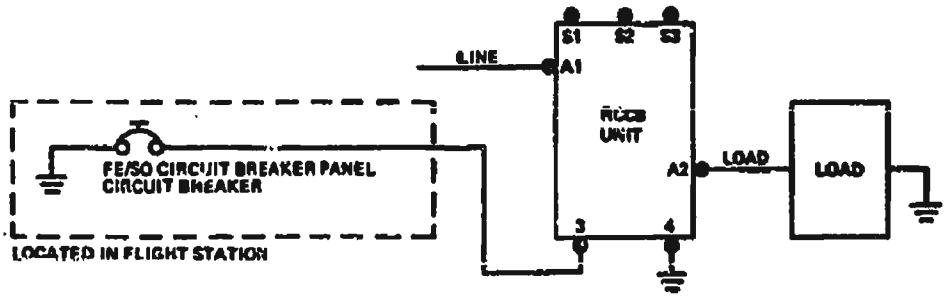
R LS14393-( ) and LS14394-( ) Remote Control
R Circuit Breaker - Removal and Installation
R Figure 401

EFFECTIVITY: ALL

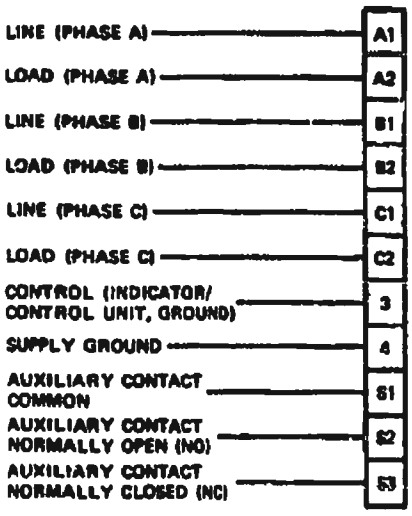


TERMINAL IDENTIFICATION

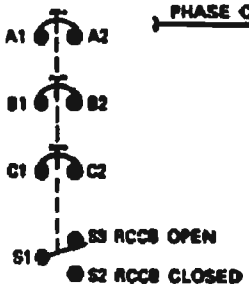
AUXILIARY CONTACT CIRCUIT (INSIDE RCCB)



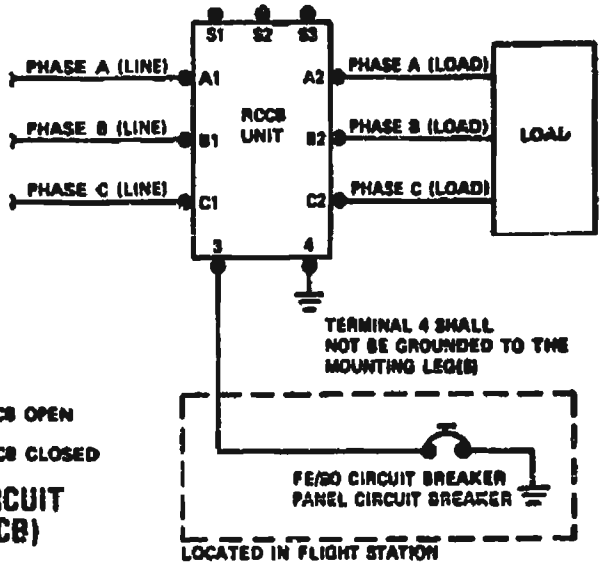
SINGLE POLE RCCB



TERMINAL IDENTIFICATION



CONTACT CIRCUIT (INSIDE RCCB)



M1-0000-24-0000

Remote Control Circuit Breaker Hook Up
Figure 402

disappearance of ON tab on pushbutton shaft. If not, check for continuity from terminal 3 to ground.

(8) On aircraft with LS14393 and or LS14394 ( ) RCCB's, open and close trip/set circuit breaker; verify RCCB opens and closes as indicated by appearance and disappearance of OPEN-CLOSE visual indicator located on right side of INTEGRATED WIRE TERMINATION MODULE (IWTS) connector. If not, check for continuity from terminal 3 to ground.

(a) If resistance is less than 8 ohms, replace RCCB.

(b) If resistance is more than 8 ohms, fault is in wiring from terminal 3 to ground thru trip/set circuit breaker and relay, where applicable.

(9) Install cover on RCCB panel.

(10) Turn off electrical power (Ref 24-41-00).

AC BUS SYSTEM - DESCRIPTION AND OPERATION

1. General

The ac bus system (Ref. Figure 1) consists of buses located in the following areas:

Mid Electrical Service Center (MESC), zone 137:

ac buses 1, 2, and 3

ac tie bus

Flight Station, zone 210:

Forward ac ground service bus

ac buses 1, 2, and 3 extensions

no. 2 ac radio bus

R ac essential bus (Ref. 24-53-00)

R ac essential radio bus (Ref. 24-53-00)

R ac standby bus (Ref. 24-53-00)

Galley area, zone 130:

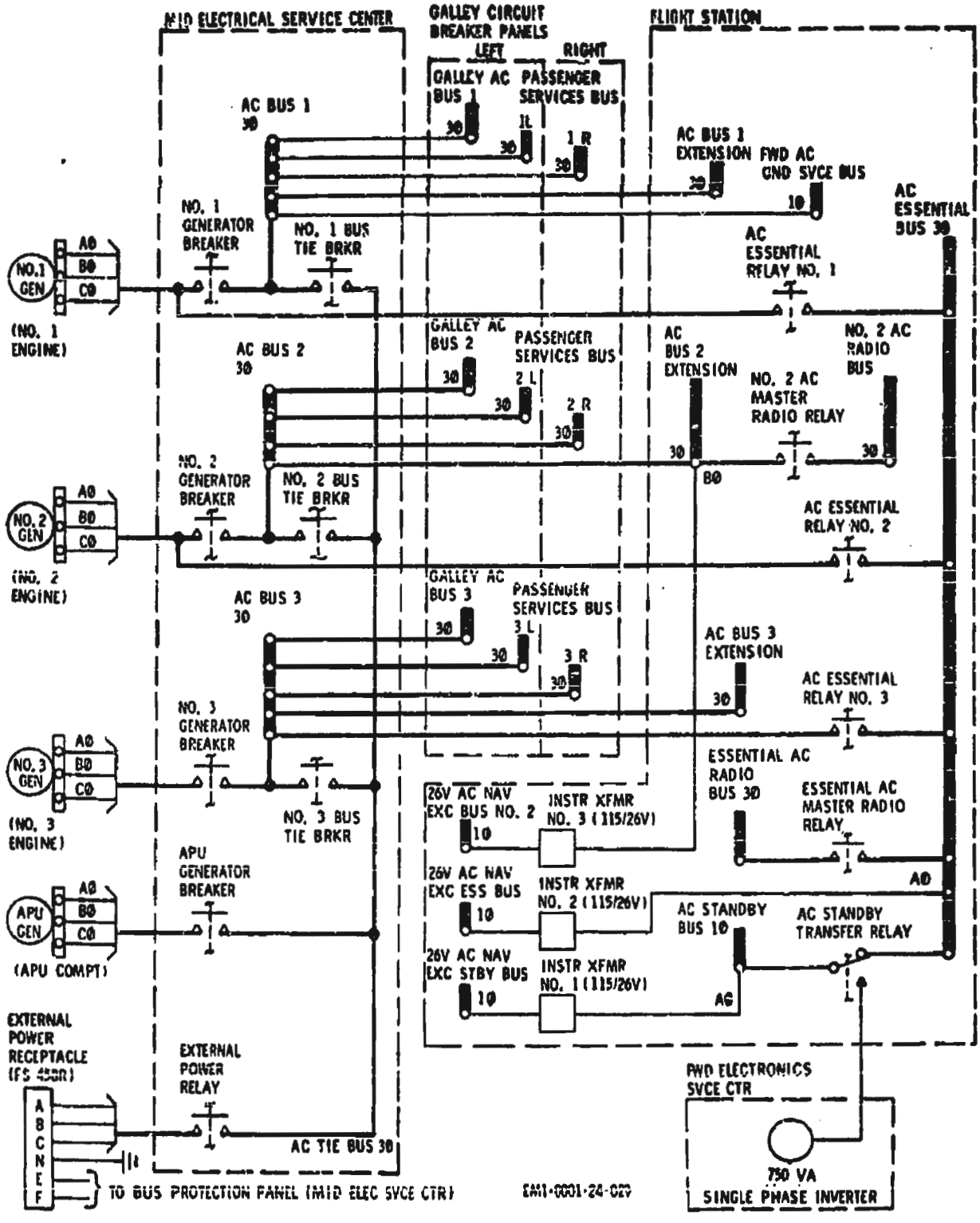
galley ac buses 1, 2, and 3

passenger service buses 1L, 1R, 2L, 2R, 3L, and 3R

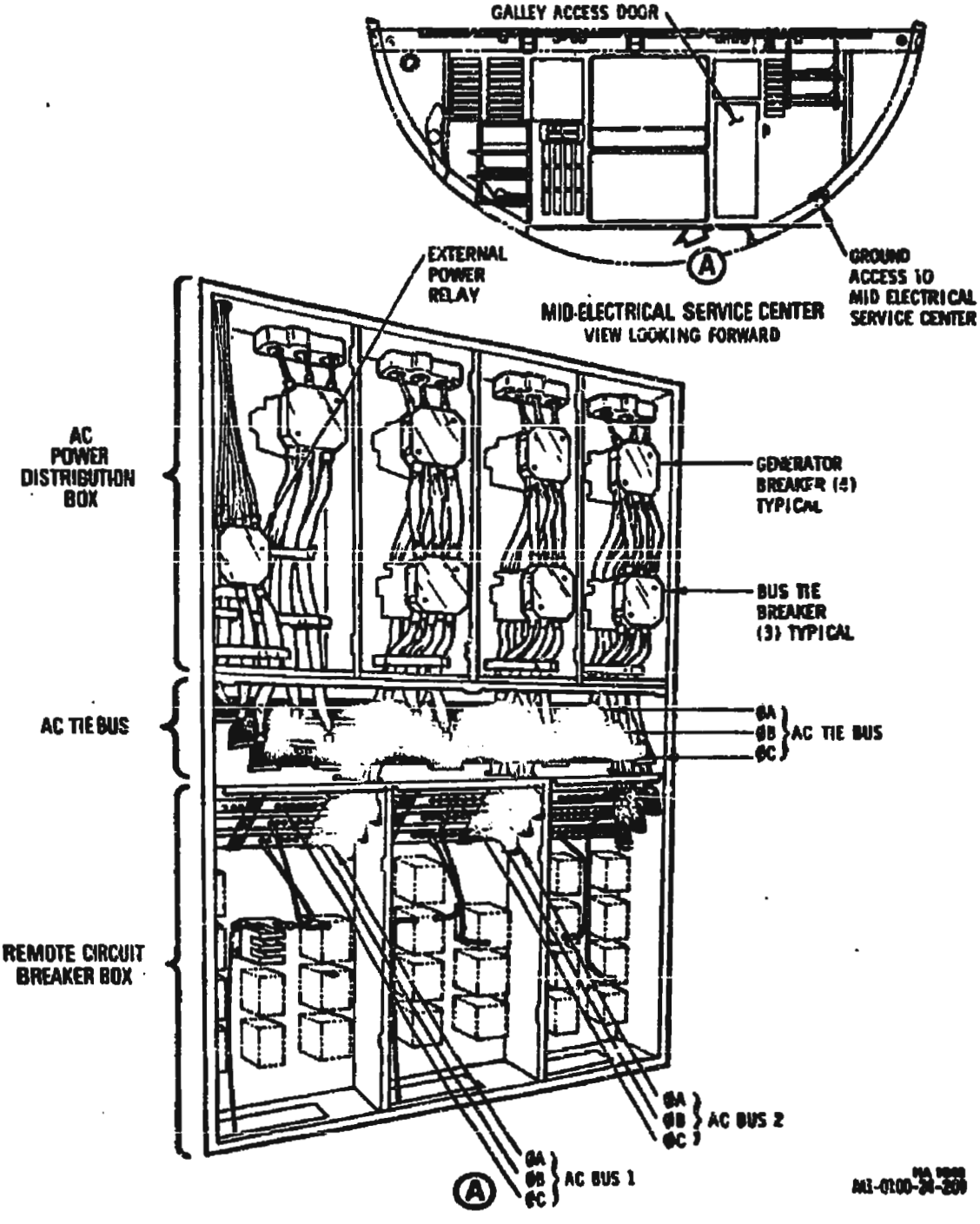
AC buses 1, 2, and 3 supply 115V ac electrical power to buses located in the Flight station and galley area circuit breaker panels. Electrical power is then provided to the various systems and components through the circuit breakers.

2. AC Buses 1, 2, and 3

Three-phase ac buses 1, 2, and 3 (Ref. Fig. 2) are located in the remote control circuit breaker (rccb) box on the forward bulkhead of the mid electrical service center. Each bus is energized primarily from its associated engine-driven generator, or secondarily through the tie bus from any other operating generator including the APU, or from an external power source (Ref. 24-41-00).


MID ELECTRICAL SERVICE CENTER
GALLEY CIRCUIT BREAKER PANELS
LEFT
RIGHT
FLIGHT STATION
GALLEY AC BUS 1
PASSENGER SERVICES BUS
AC BUS 1
AC BUS 1 EXTENSION
FWD AC GND SVCE BUS
AC ESSENTIAL BUS 30
NO. 1 GENERATOR BREAKER
NO. 1 BUS TIE BRKR
AC ESSENTIAL RELAY NO. 1
NO.1 GEN
(NO. 1 ENGINE)
GALLEY AC BUS 2
PASSENGER SERVICES BUS
AC BUS 2
AC BUS 2 EXTENSION
NO. 2 AC RADIO BUS
NO. 2 AC MASTER RADIO RELAY
NO. 2 GENERATOR BREAKER
NO. 2 BUS TIE BRKR
AC ESSENTIAL RELAY NO. 2
NO. 2 GEN
(NO. 2 ENGINE)
GALLEY AC BUS 3
PASSENGER SERVICES BUS
AC BUS 3
AC BUS 3 EXTENSION
AC ESSENTIAL RELAY NO. 3
NO. 3 GENERATOR BREAKER
NO. 3 BUS TIE BRKR
ESSENTIAL AC RADIO BUS 30
ESSENTIAL AC MASTER RADIO RELAY
NO. 3 GEN
(NO. 3 ENGINE)
26V AC NAV EXC BUS NO. 2
INSTR XFMR NO. 3 (115/26V)
APU GENERATOR BREAKER
26V AC NAV EXC ESS BUS
INSTR XFMR NO. 2 (115/26V)
AC STANDBY BUS 10
AC STANDBY TRANSFER RELAY
APU GEN
(APU COMPT)
26V AC NAV EXC STBY BUS
INSTR XFMR NO. 1 (115/26V)
EXTERNAL POWER RECEPTACLE (FS 455R)
EXTERNAL POWER RELAY
AC TIE BUS 30
FWD ELECTRONICS SVCE CTR
750 VA SINGLE PHASE INVERTER
TO BUS PROTECTION PANEL (MID ELEC SVCE CTR)
EAI-0001-24-020

R AC Bus Distribution System Simplified Schematic
R Figure 1



AC Buses 1, 2, and 3 and Tie Bus Locations
Figure 2

3. AC Tie Bus

The three-phase ac tie bus (Ref. Fig. 2) is located in the ac tie bus compartment, just above the RCCB box, on the forward bulkhead of the mid electrical service center. The tie bus provides a means of paralleling the four generator outputs.

4. AC Buses 1, 2, and 3 Extensions

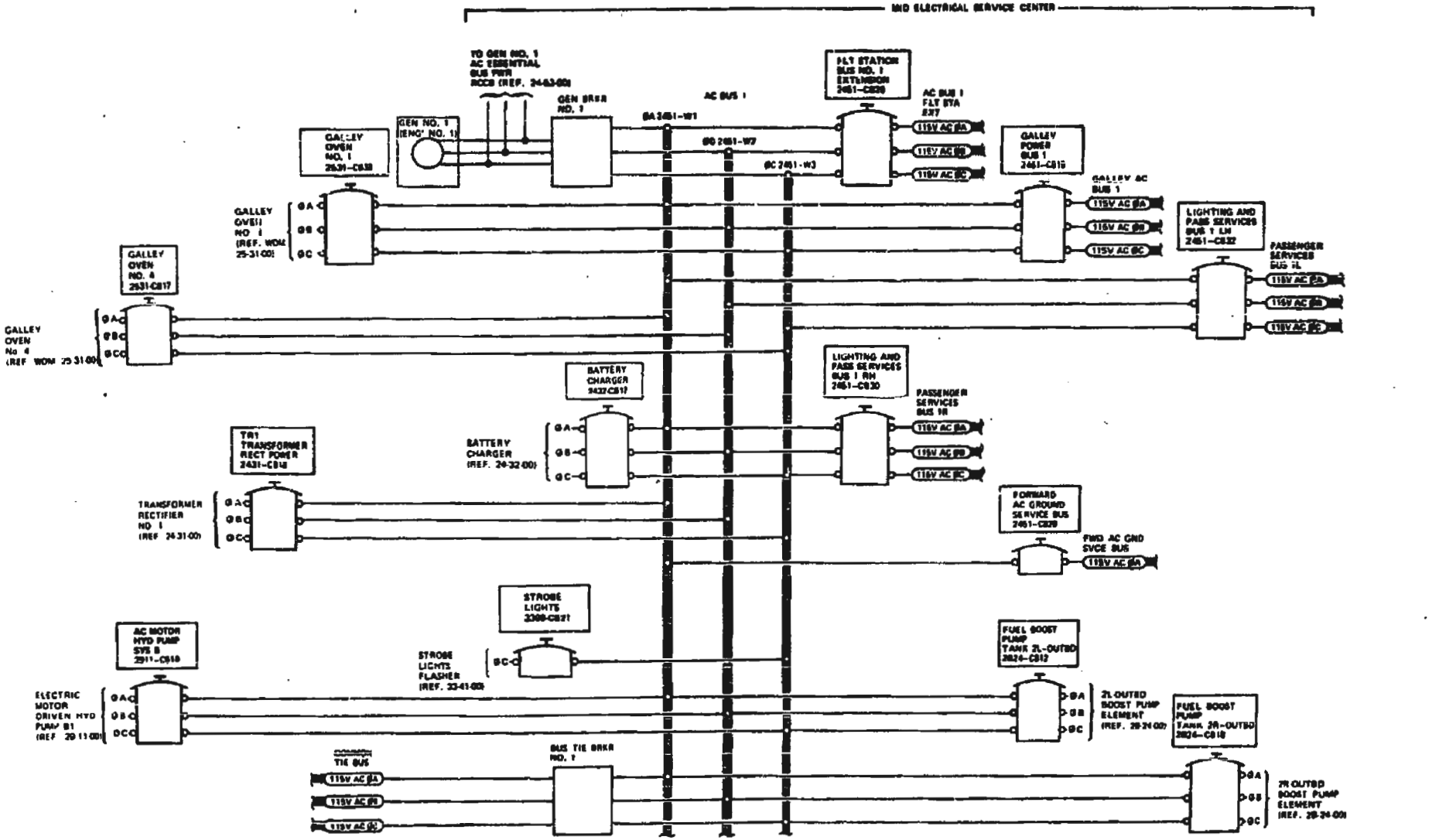
AC buses 1, 2, and 3 extensions, located in the Flight station circuit breaker panels, provide three-phase electrical power to using systems and components in the flight station. AC buses 1, 2, and 3 supply electrical power; through rccb's, to the bus extensions (Ref. Figures 3, 4, and 5).

Overload protection of the bus extensions is provided by the FLT STATION BUS NO. 1, NO. 2, and NO. 3 rccb's located in
R the rccb box in the MESC (Ref. Figure 2).

A. AC Extension Bus Fail Indication Relay

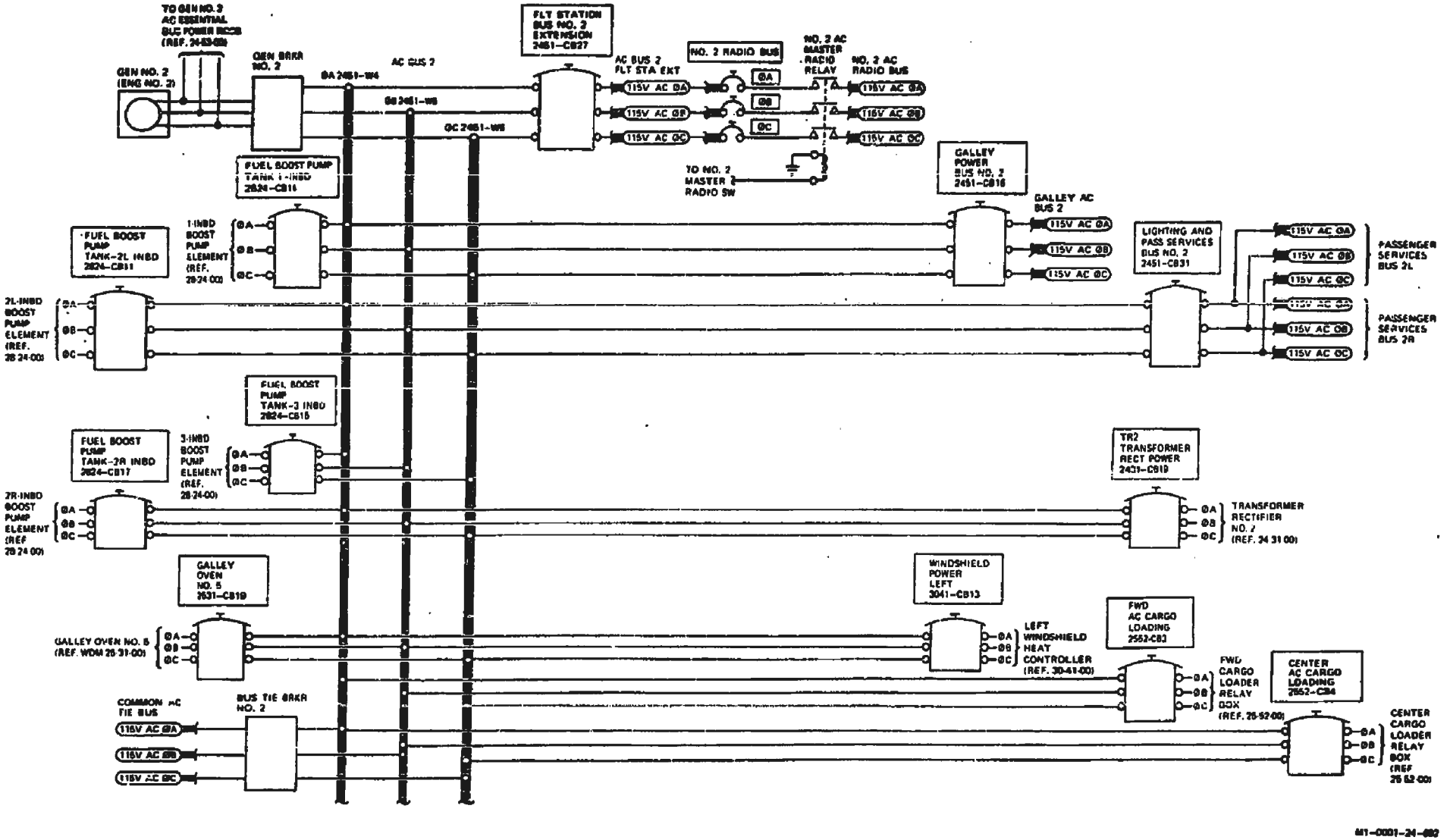
Failure indication relays (one relay associated with each bus extension) located in the forward electronic service center, zone 112, detect a failed ac bus 1, 2, or 3 extension and turns on the FLT STA BUS FAIL caution light on the Flight Engineer/Second Officers (FE/SO) electrical control panel. The light remains on until the failed bus extension is reenergized. Whenever a FLT STA BUS FAIL light comes on, the ELECTRICAL SYSTEM caution light on the pilots center instrument panel, zone 210, begins to flash (Ref. Figure 6). The relay is a double-pole, double-throw, undervoltage-sensing, three-phase, continuous-duty unit which senses ac generator output. When all three phases of a generator output reach 104 (±2) volts, the associated relay energizes. The energized relay causes its associated FLT STA BUS FAIL light on the FE/SO electrical control panel to go off.

Whenever the average of the three-phase generator output voltage decreases to 95 (±2) volts, the associated sensing relay deenergizes and causes its FLT STA BUS FAIL light to come on. Relay actuation is delayed approximately 100 to 150 milliseconds to avoid nuisance failure indications during normal power switching transients. Refer to 33-17-00 for description and operation of the annunciator system.

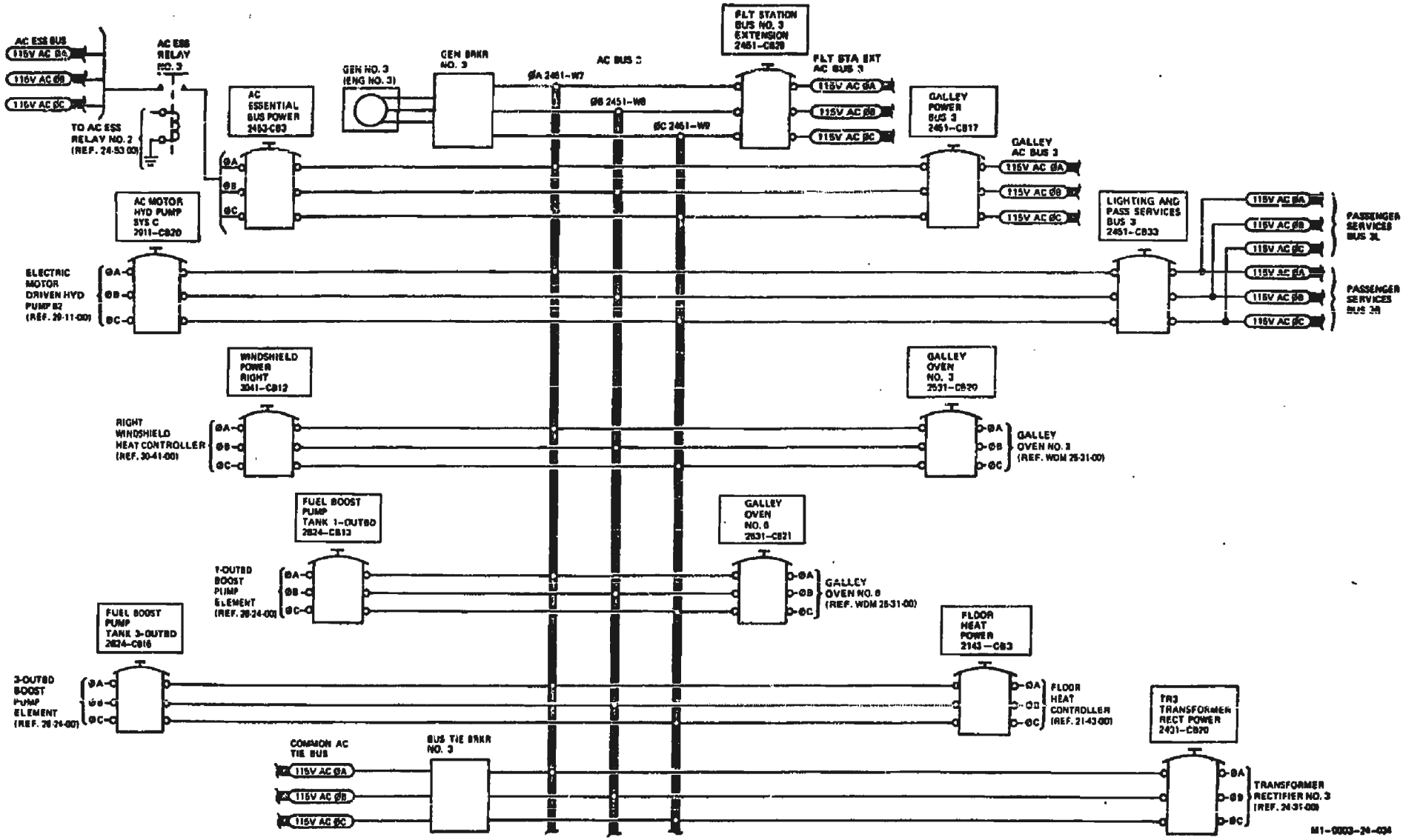

MID ELECTRICAL SERVICE CENTER
TO GEN NO. 1 AC ESSENTIAL BUS PWR RCCB (REF. 24-63-00)
GEN BRKR NO. 1
GEN NO. 1 (ENG. NO. 1)
AC BUS 1
FLT STATION BUS NO. 1 EXTENSION 2461-CB28
AC BUS 1 FLT STA EXT
GALLEY OVEN NO. 1 2631-CB38
GALLEY POWER BUS 1 2461-CB15
GALLEY AC BUS 1
LIGHTING AND PASS SERVICES BUS 1 LH 2461-CB32
PASSENGER SERVICES BUS 1L
GALLEY OVEN NO. 1 (REF. WDM 25-31-00)
GALLEY OVEN NO. 4 2631-CB17
GALLEY OVEN No. 4 (REF WDM 25-31-00)
BATTERY CHARGER 2432-CB17
LIGHTING AND PASS SERVICES BUS 1 RH 2461-CB30
PASSENGER SERVICES BUS 1R
BATTERY CHARGER (REF. 24-32-00)
TR1 TRANSFORMER RECT POWER 2431-CB18
TRANSFORMER RECTIFIER NO. 1 (REF. 24-31-00)
FORWARD AC GROUND SERVICE BUS 2461-CB28
FWD AC GND SVCE BUS
STROBE LIGHTS 2308-CB21
STROBE LIGHTS FLASHER (REF. 33-41-00)
AC MOTOR HYD PUMP SYS B 2911-CB18
FUEL BOOST PUMP TANK 2L-OUTBD 2824-CB12
ELECTRIC MOTOR DRIVEN HYD PUMP B1 (REF. 29-11-00)
2L OUTBD BOOST PUMP ELEMENT (REF. 28-24-00)
FUEL BOOST PUMP TANK 2R-OUTBD 2824-CB18
TIE BUS
BUS TIE BRKR NO. 1
2R OUTBD BOOST PUMP ELEMENT (REF. 28-24-00)
115V AC

M1-0010-24-032

R AC BUS 1 Distribution System Simplified Schematic
R Figure 3

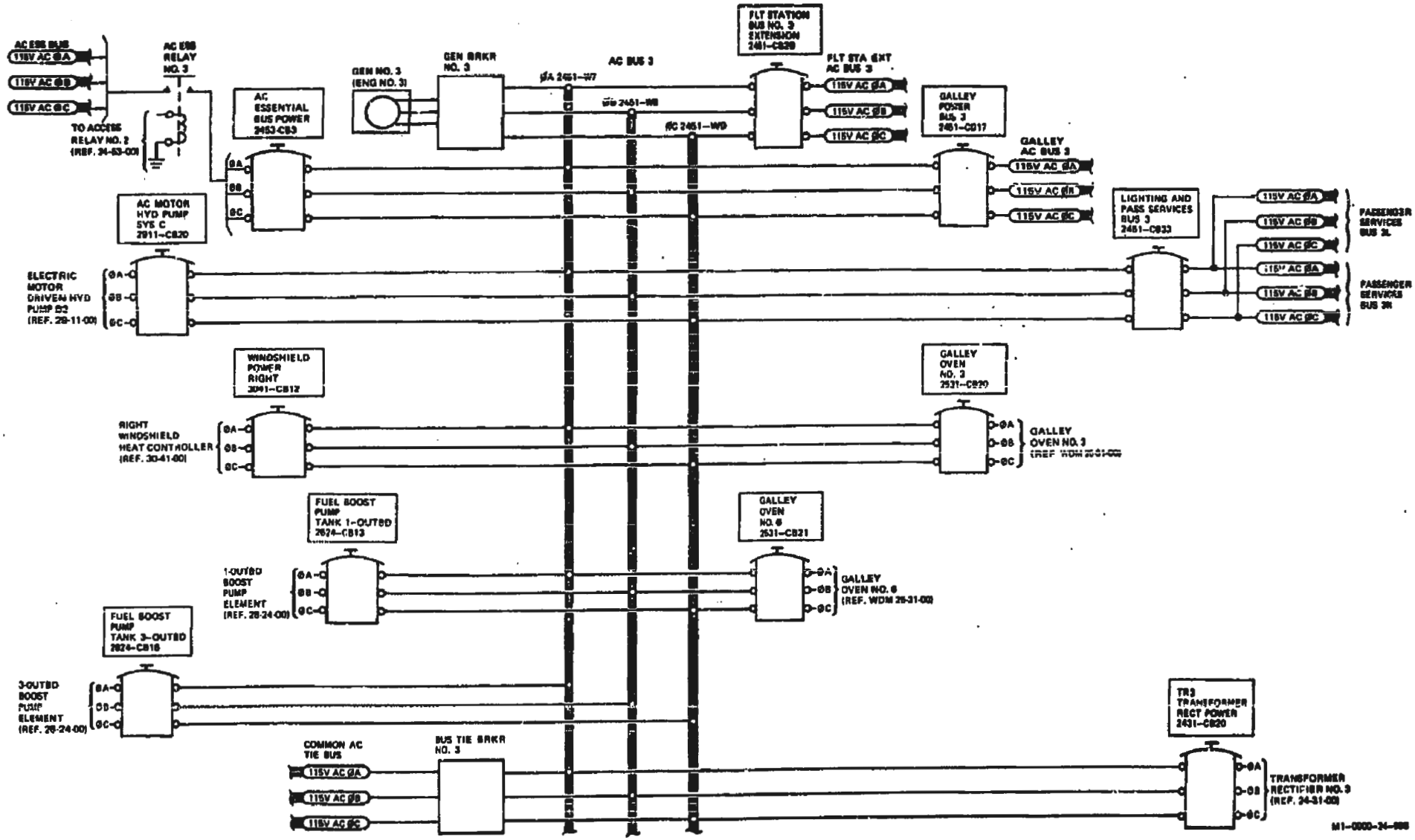

TO GEN NO. 2 AC ESSENTIAL BUS POWER RCDR (REF. 24-53-00)
GEN NO. 2 (ENG NO. 2)
GEN BRKR NO. 2
AC BUS 2
ØA 2451-W4
ØB 2451-W5
ØC 2451-W6
FLT STATION BUS NO. 2 EXTENSION 2451-CB27
AC BUS 2 FLT STA EXT
115V AC ØA
115V AC ØB
115V AC ØC
NO. 2 RADIO BUS
ØA
ØB
ØC
NO. 2 AC MASTER RADIO RELAY
NO. 2 AC RADIO BUS
TO NO. 2 MASTER RADIO SW
FUEL BOOST PUMP TANK 1-INBD 2824-CB16
1-INBD BOOST PUMP ELEMENT (REF. 28-24-00)
FUEL BOOST PUMP TANK-2L INBD 2824-CB11
2L-INBD BOOST PUMP ELEMENT (REF. 28-24-00)
FUEL BOOST PUMP TANK-3 INBD 2824-CB15
3-INBD BOOST PUMP ELEMENT (REF. 28-24-00)
FUEL BOOST PUMP TANK-2R INBD 2824-CB17
2R-INBD BOOST PUMP ELEMENT (REF 28-24-00)
GALLEY POWER BUS NO. 2 2451-CB16
GALLEY AC BUS 2
LIGHTING AND PASS SERVICES BUS NO. 2 2451-CB31
PASSENGER SERVICES BUS 2L
PASSENGER SERVICES BUS 2R
TR2 TRANSFORMER RECT POWER 2431-CB19
TRANSFORMER RECTIFIER NO. 2 (REF. 24-31-00)
GALLEY OVEN NO. 5 2631-CB19
GALLEY OVEN NO. 5 (REF. WDM 26-31-00)
WINDSHIELD POWER LEFT 3041-CB13
LEFT WINDSHIELD HEAT CONTROLLER (REF. 30-41-00)
FWD AC CARGO LOADING 2552-CB3
FWD CARGO LOADER RELAY BOX (REF. 25-52-00)
CENTER AC CARGO LOADING 2552-CB4
CENTER CARGO LOADER RELAY BOX (REF 25-52-00)
COMMON AC TIE BUS
BUS TIE BRKR NO. 2
M1-0001-24-002

R AC BUS 2 Distribution System Simplified Schematic
R Figure 4


AC ESS BUS
115V AC ØA
115V AC ØB
115V AC ØC
AC ESS RELAY NO. 3
TO AC ESS RELAY NO. 2 (REF. 24-53-00)
AC ESSENTIAL BUS POWER 2453-CB3
GEN NO. 3 (ENG NO. 3)
GEN BKR NO. 3
AC BUS 3
ØA 2451-W7
ØB 2451-W8
ØC 2451-W9
FLT STATION BUS NO. 3 EXTENSION 2451-CB20
FLT STA EXT AC BUS 3
GALLEY POWER BUS 3 2451-CB17
GALLEY AC BUS 3
LIGHTING AND PASS SERVICES BUS 3 2451-CB33
PASSENGER SERVICES BUS 3L
PASSENGER SERVICES BUS 3R
AC MOTOR HYD PUMP SYS C 2911-CB20
ELECTRIC MOTOR DRIVEN HYD PUMP B2 (REF. 29-11-00)
WINDSHIELD POWER RIGHT 3041-CB12
RIGHT WINDSHIELD HEAT CONTROLLER (REF. 30-41-00)
GALLEY OVEN NO. 3 2531-CB20
GALLEY OVEN NO. 3 (REF. WDM 25-31-00)
FUEL BOOST PUMP TANK 1-OUTBD 2824-CB13
1-OUTBD BOOST PUMP ELEMENT (REF. 28-24-00)
GALLEY OVEN NO. 6 2531-CB21
GALLEY OVEN NO. 6 (REF. WDM 25-31-00)
FUEL BOOST PUMP TANK 3-OUTBD 2824-CB16
3-OUTBD BOOST PUMP ELEMENT (REF. 28-24-00)
FLOOR HEAT POWER 2143-CB3
FLOOR HEAT CONTROLLER (REF. 21-43-00)
TR3 TRANSFORMER RECT POWER 2431-CB20
TRANSFORMER RECTIFIER NO. 3 (REF. 24-31-00)
COMMON AC TIE BUS
BUS TIE BKR NO. 3
M1-0003-24-034

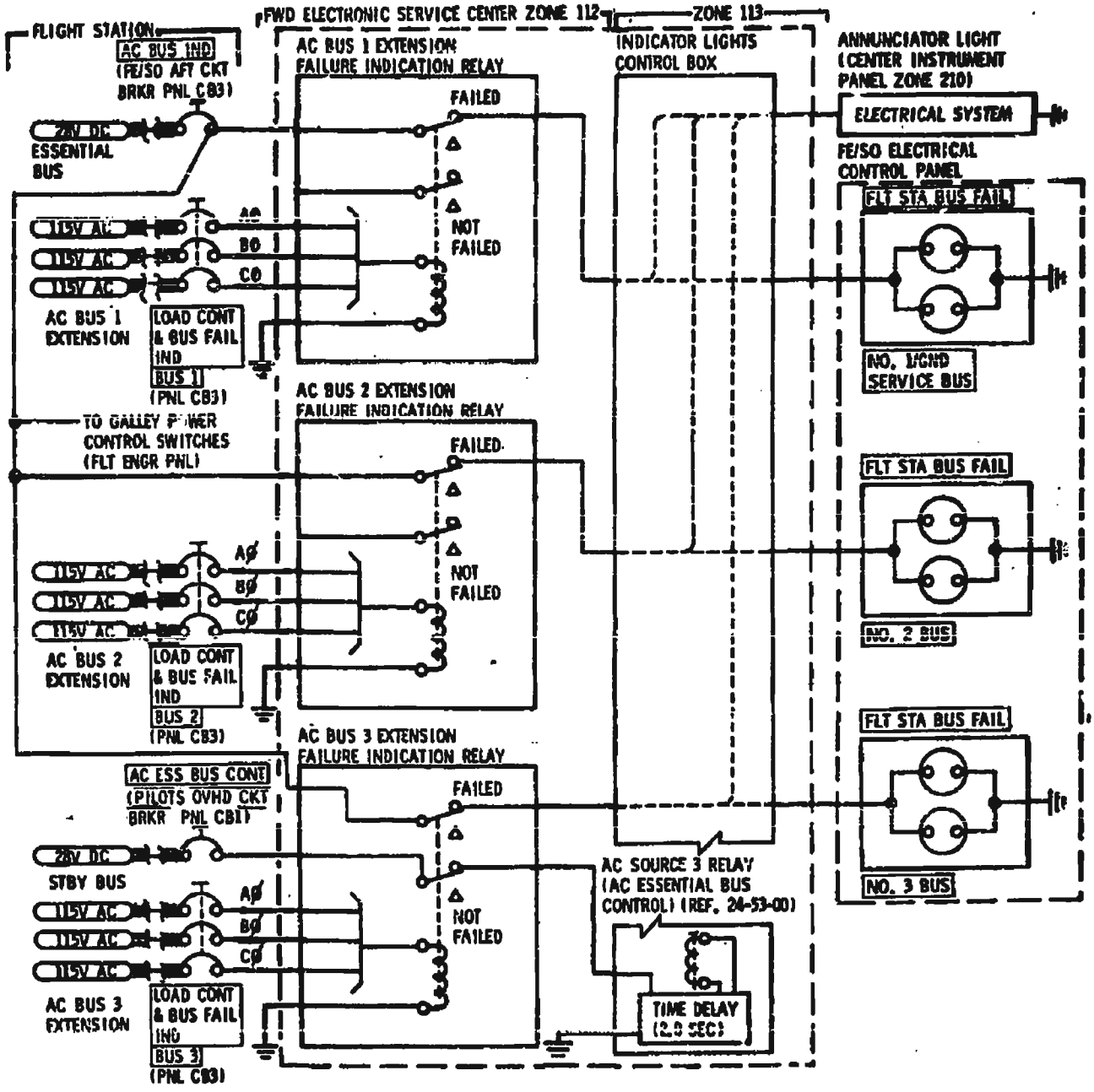
AC BUS 3 Distribution System Simplified Schematic
Figure 5

R EFFECTIVITY: 001-031 WITHOUT SB21-228
R
001B


AC ESS BUS
115V AC ØA
115V AC ØB
115V AC ØC
AC ESS RELAY NO. 3
TO ACCESS RELAY NO. 2 (REF. 24-53-00)
AC ESSENTIAL BUS POWER 2453-CB3
GEN NO. 3 (ENG NO. 3)
GEN BRKR NO. 3
AC BUS 3
ØA 2451-W7
ØB 2451-W8
ØC 2451-W9
FLT STATION BUS NO. 3 EXTENSION 2451-CB29
FLT STA EXT AC BUS 3
GALLEY POWER BUS 3 2451-CB17
GALLEY AC BUS 3
LIGHTING AND PASS SERVICES BUS 3 2451-CB33
PASSENGER SERVICES BUS 3L
PASSENGER SERVICES BUS 3R
AC MOTOR HYD PUMP SYS C 2911-CB20
ELECTRIC MOTOR DRIVEN HYD PUMP B2 (REF. 29-11-00)
WINDSHIELD POWER RIGHT 3041-CB12
RIGHT WINDSHIELD HEAT CONTROLLER (REF. 30-41-00)
GALLEY OVEN NO. 3 2531-CB20
GALLEY OVEN NO. 3 (REF. WDM 25-31-00)
FUEL BOOST PUMP TANK 1-OUTBD 2624-CB13
1-OUTBD BOOST PUMP ELEMENT (REF. 28-24-00)
GALLEY OVEN NO. 6 2531-CB21
GALLEY OVEN NO. 6 (REF. WDM 25-31-00)
FUEL BOOST PUMP TANK 3-OUTBD 2624-CB16
3-OUTBD BOOST PUMP ELEMENT (REF. 28-24-00)
COMMON AC TIE BUS
BUS TIE BRKR NO. 3
TR3 TRANSFORMER RECT POWER 2431-CB20
TRANSFORMER RECTIFIER NO. 3 (REF. 24-31-00)

AC BUS 3 Distribution System Simplified Schematic
Figure 5

R EFFECTIVITY: 001-031 WITH SB21-228 AND
R 032-999
001B


FLIGHT STATION
AC BUS IND
(FE/SO AFT CKT BRKR PNL C83)
28V DC ESSENTIAL BUS
115V AC
AC BUS 1 EXTENSION
LOAD CONT & BUS FAIL IND
BUS 1
(PNL C83)
FWD ELECTRONIC SERVICE CENTER ZONE 112
ZONE 113
AC BUS 1 EXTENSION FAILURE INDICATION RELAY
FAILED
NOT FAILED
INDICATOR LIGHTS CONTROL BOX
ANNUNCIATOR LIGHT (CENTER INSTRUMENT PANEL ZONE 210)
ELECTRICAL SYSTEM
FE/SO ELECTRICAL CONTROL PANEL
FLT STA BUS FAIL
NO. 1/GND SERVICE BUS
TO GALLEY POWER CONTROL SWITCHES (FLT ENGR PNL)
AC BUS 2 EXTENSION FAILURE INDICATION RELAY
AC BUS 2 EXTENSION
LOAD CONT & BUS FAIL IND
BUS 2
(PNL C83)
NO. 2 BUS
AC ESS BUS CONT
(PILOTS OVHD CKT BRKR PNL C81)
STBY BUS
AC BUS 3 EXTENSION FAILURE INDICATION RELAY
AC BUS 3 EXTENSION
LOAD CONT & BUS FAIL IND
BUS 3
(PNL C83)
NO. 3 BUS
AC SOURCE 3 RELAY (AC ESSENTIAL BUS CONTROL) (REF. 24-53-00)
TIME DELAY (2.0 SEC)

HN 3639
EMI-0104-24-035

AC Bus 1, 2, and 3 Extension Fail Indication System
Simplified Schematic
Figure 6

5. Galley AC Buses 1, 2, and 3

Galley ac buses 1, 2, and 3, located on the galley left circuit breaker panel, provide three-phase electrical power to all using systems and components in the galley area.

AC buses 1, 2, and 3 supply electrical power, through rccb's, to the galley buses (Ref. Figures 3, 4, and 5).

Overload protection of the galley buses is provided by the GALLEY POWER BUS NO. 1, NO. 2, and NO. 3 rccb's located in the rccb box in the MESC (Ref. 24-00-00).

6. Passenger Service Buses

Passenger service buses 1L, 1R, 2L, 2R, 3L, and 3R, located on the galley left and right circuit breaker panels, provide three phase electrical power to the various using systems and components.

AC buses 1, 2, and 3 supply electrical power, through rccb's, to the passenger service buses (Ref. Figures 3, 4, and 5).
R Overload protection of the passenger service buses is provided by their respective rccb's located in the rccb box in the MESC (Ref. Figure 2).

7. No. 2 AC Radio Bus

The No. 2 ac radio bus (Ref. Figure 7) provides three-phase electrical power to navigation, communications, radar, and other avionic systems controlled from the flight station.

Electrical power to the NO. 2 ac radio bus is provided from ac bus 2 extension through contacts of the No. 2 ac master radio relay. The relay is energized by pressing (Latched in) the NO. 2 MASTER RADIO switchlight on the pilots overhead panel, zone 210. Overload protection of the NO. 2 ac radio bus is provided by three single phase, push-pull circuit breakers located on the FE/SO aft circuit breaker panel CB3, zone 215.

A. No. 2 AC Master Radio Relay

The dc-operated No. 2 ac master radio relay used in the ac distribution system is a 25-ampere, triple-pole, single-throw unit. The relay has, in addition to the main 25-ampere contacts, one set of single-pole, double-throw auxiliary contacts. The relay is located in the flight station overhead circuit breaker panel area, zone 215. When energized, the main contacts connect the No. 2 ac radio bus to the ac bus 2 extension. The relay is energized when the

No. 2 MASTER RADIO switchlight on the pilots overhead panel, zone 210, is depressed (latched in).

8. Forward AC Ground Service Bus

The forward ac ground service bus, located on the FE/SO overhead CB panel (CB2) and FE/SO aft CB panel (CB3), provide a single phase (Aφ) electrical power to the various using systems and components. Circuits powered by this bus are available in the ground service operating mode as well as under full power conditions.

AC bus 1 supplies electrical power, through an rccb, to the forward ac ground service bus (Ref. Figure 3).

Overload protection of the bus is provided by the FORWARD AC GROUND SERVICE BUS rccb located on the ac bus no. 1 rccb box in the MESC (Ref. Figure 2).

9. Bus Load Monitoring System

An automatic load monitoring system (Ref. Fig. 8) removes certain nonessential loads if the total current from any generator or external power exceeds a selected value. The overcurrent is sensed by one of the generator control units or the bus protection panel which will provide a 28V dc output signal. The signal actuates a relay system to monitor the galley and the electric-driven hydraulic pump loads.

When an overcurrent condition is sensed by any generator control unit or by the bus protection panel, or when the SELF TEST switch on the GENERATOR SYSTEM FAILURE panel is pressed, the generator overload relay energizes (Ref. Fig. 8). The overload relay energizes the AC motor hydraulic pump monitor relay and the galley control relay.

The energized AC motor hydraulic pump monitor relay removes all power from hydraulic systems B and C AC motor pumps. The power remains locked out until all four (two located in flight station and two in the hydraulic service center) hydraulic system B and C motor pump switches are opened (Ref. 29-11-00).

The energized galley control relay provides a control ground to energize each of the three galley power relays which, in turn, remove control grounds from the galley rccb's. Galley power is then removed and the OFF legend in all three GALLEY POWER switchlights come on.

At this time, the overcurrent condition is no longer present, and the generator overload relay deenergizes; the galley control

relay remains energized through a lock-in circuit until all three GALLEY POWER switchlights are released (out). The lock-in circuits prevent cycling of the loads when the overcurrent condition is relieved. The hydraulic pump and galley systems can be reset independently of each other.

A. Generator Overload Relay

The generator overload relay is a polarized, 10-ampere, four-pole, double-throw, sealed unit that plugs into a prewired socket in the forward electronic service center, zone 112.

The normally open relay is energized with a generator overload signal from any generator control unit, an external power overload signal from the bus protection panel, or a signal from the SELF TEST switch on the GENERATOR SYSTEM FAILURE panel in the mid electrical service center, zone 137.

When energized, the relay energizes the galley control relay and the ac motor pump monitor relays.

B. Galley Control Relay

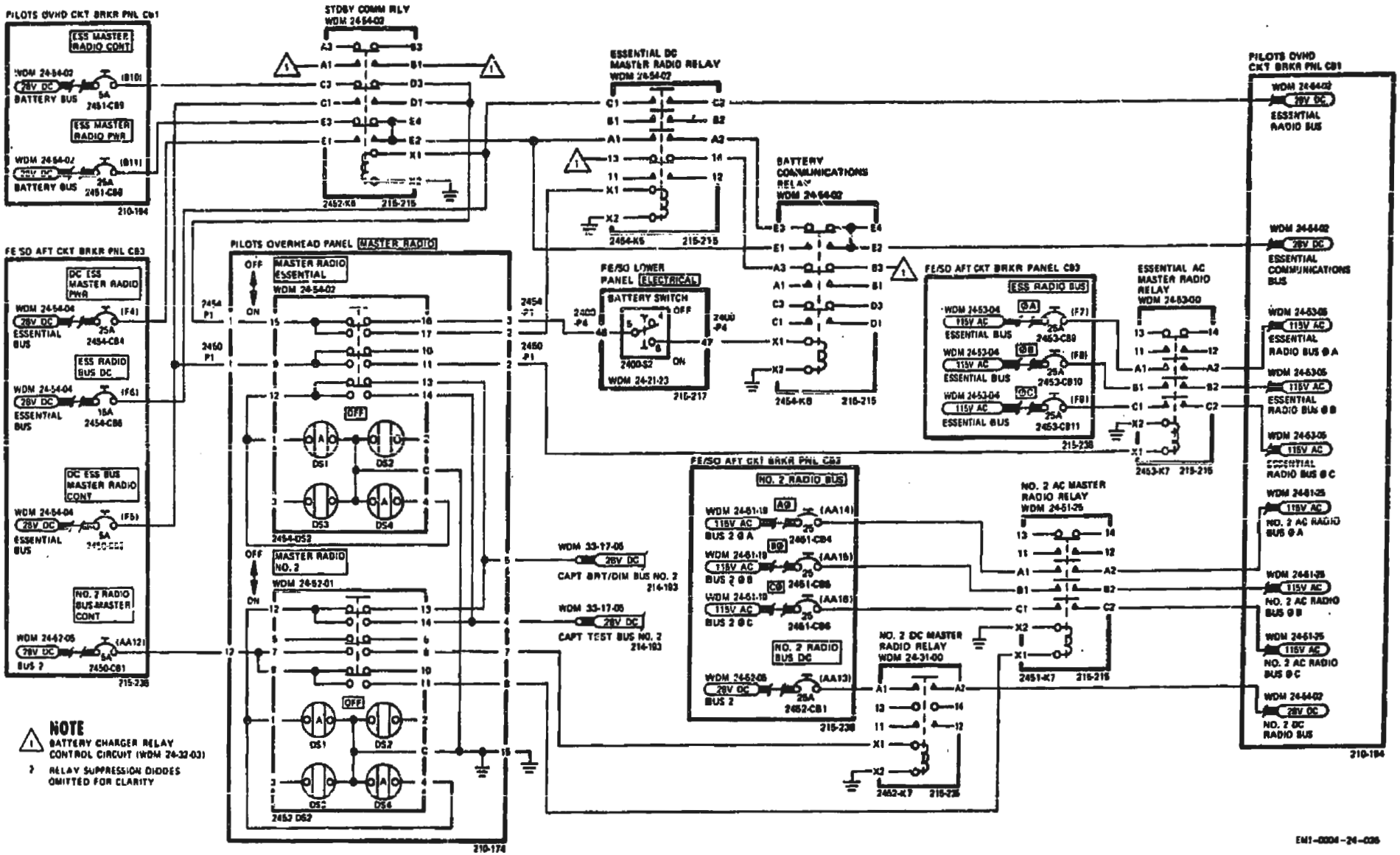
The galley control relay is used in the ac power distribution system. If galley power is on, the relay deenergizes all galley ac circuits whenever an overcurrent signal is received from the generator overload relay.

The relay is a polarized, 10-ampere, four-pole, double-throw, sealed unit that has 14 gold-over-silver-plated plug-in-type contacts. The normally open relay plugs into a prewired socket in the forward electronic service center, zone 112.

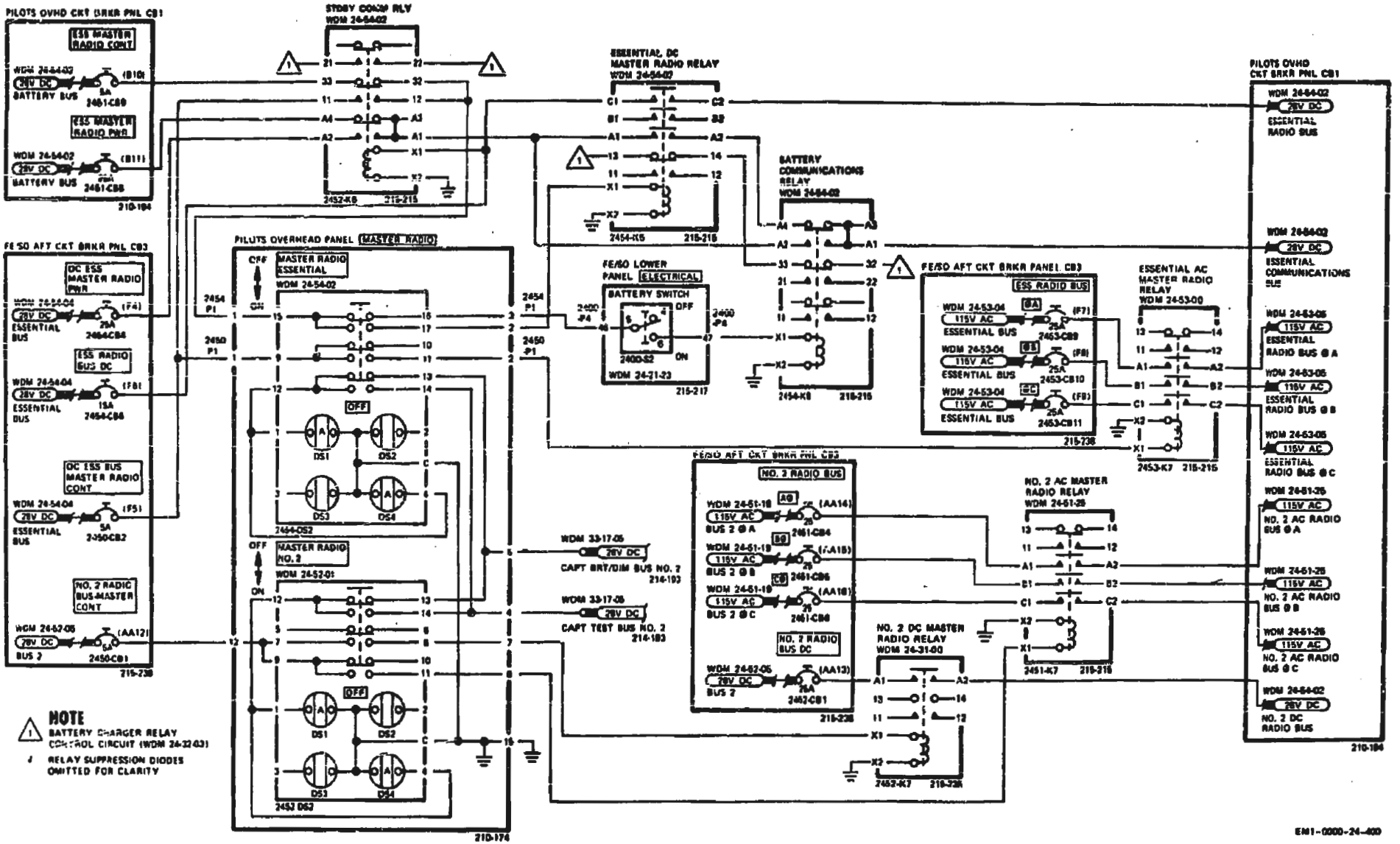
When energized, the galley control relay energizesbuses 1, 2, and 3 galley power relays, which, in turn, remove the grounds from all galley three-phase remote controlled circuit breakers. The relay provides a self-lock-in circuit through its own contacts. If galley power is on, the power will fail, and the OFF lights in the GALLEY POWER switchlights on the ELECTRICAL panel, zone 215, will come on. Galley power is restored by releasing and resetting (latched in) all three GALLEY POWER switchlights.

C. AC Motor Pump Monitor Relay

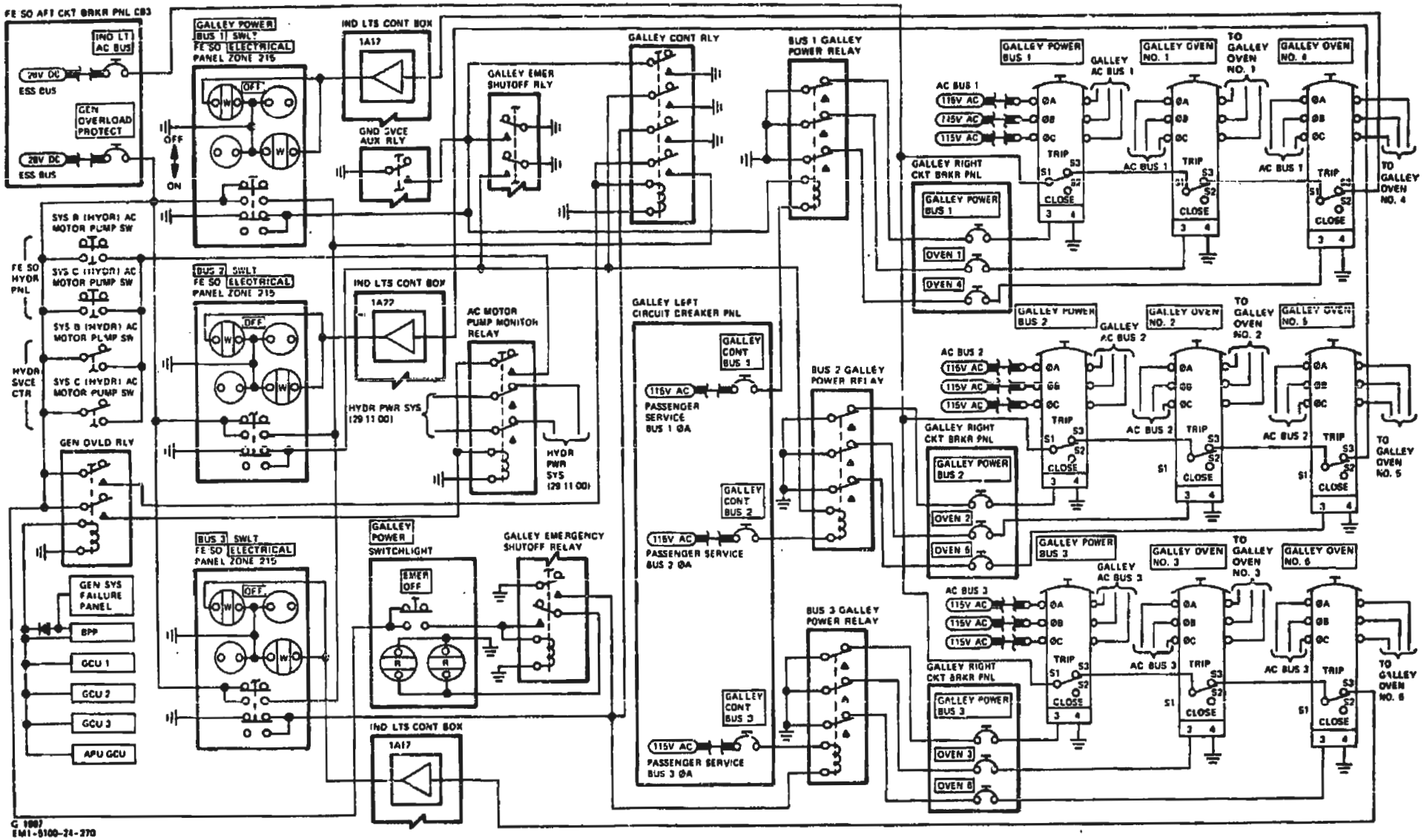
The ac motor pump monitor relay is a polarized, 10-ampere, four-pole, double-throw sealed unit which plugs into a prewired socket in the forward electronic service center, zone 112.


PILOTS OVHD CKT BRKR PNL CB1
ESS MASTER RADIO CONT
ESS MASTER RADIO PWR
BATTERY BUS
STDBY COMM RLY WDM 24-54-02
ESSENTIAL DC MASTER RADIO RELAY WDM 24-54-02
BATTERY COMMUNICATIONS RELAY WDM 24-54-02
PILOTS OVHD CKT BRKR PNL CB1
ESSENTIAL RADIO BUS
ESSENTIAL COMMUNICATIONS BUS
ESSENTIAL RADIO BUS ⊕A
ESSENTIAL RADIO BUS ⊕B
ESSENTIAL RADIO BUS ⊕C
NO. 2 AC RADIO BUS ⊕A
NO. 2 AC RADIO BUS ⊕B
NO. 2 AC RADIO BUS ⊕C
NO. 2 DC RADIO BUS
FE/SO AFT CKT BRKR PNL CB3
DC ESS MASTER RADIO PWR
ESS RADIO BUS DC
DC ESS BUS MASTER RADIO CONT
NO. 2 RADIO BUS-MASTER CONT
ESSENTIAL BUS
BUS 2
PILOTS OVERHEAD PANEL MASTER RADIO
MASTER RADIO ESSENTIAL
MASTER RADIO NO. 2
FE/SO LOWER PANEL ELECTRICAL
BATTERY SWITCH
FE/SO AFT CKT BRKR PANEL CB3
ESS RADIO BUS
ESSENTIAL AC MASTER RADIO RELAY WDM 24-53-00
FE/SO AFT CKT BRKR PNL CB3
NO. 2 RADIO BUS
NO. 2 AC MASTER RADIO RELAY WDM 24-51-25
NO. 2 DC MASTER RADIO RELAY WDM 24-31-00
NO. 2 RADIO BUS DC
BUS 2 ⊕A
BUS 2 ⊕B
BUS 2 ⊕C
CAPT BRT/DIM BUS NO. 2
CAPT TEST BUS NO. 2
NOTE
1 BATTERY CHARGER RELAY CONTROL CIRCUIT (WDM 24-32-03)
2 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY

Radio and Communications Power Distribution System
Figure 7

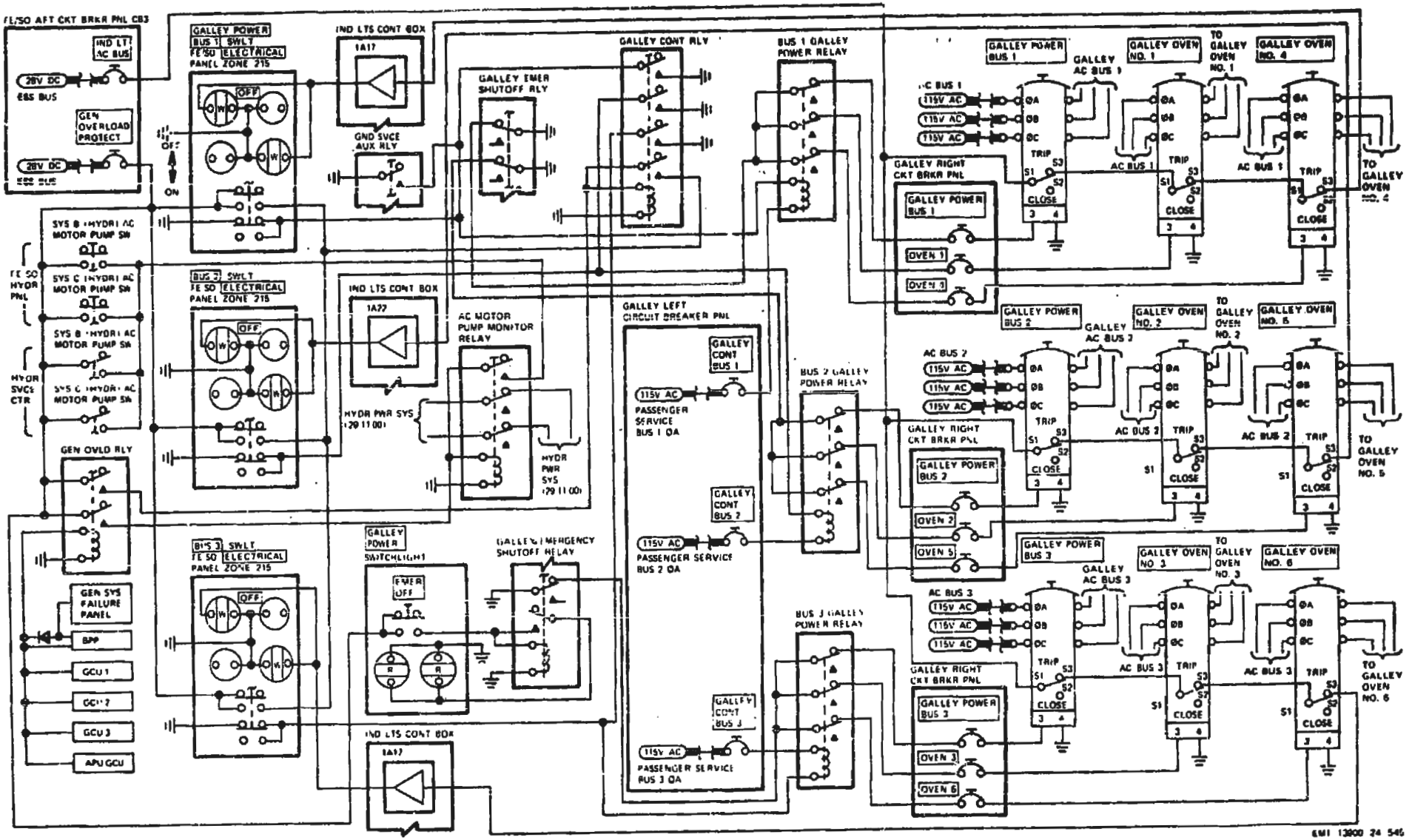


Radio and Communications Power Distribution System
Figure 7



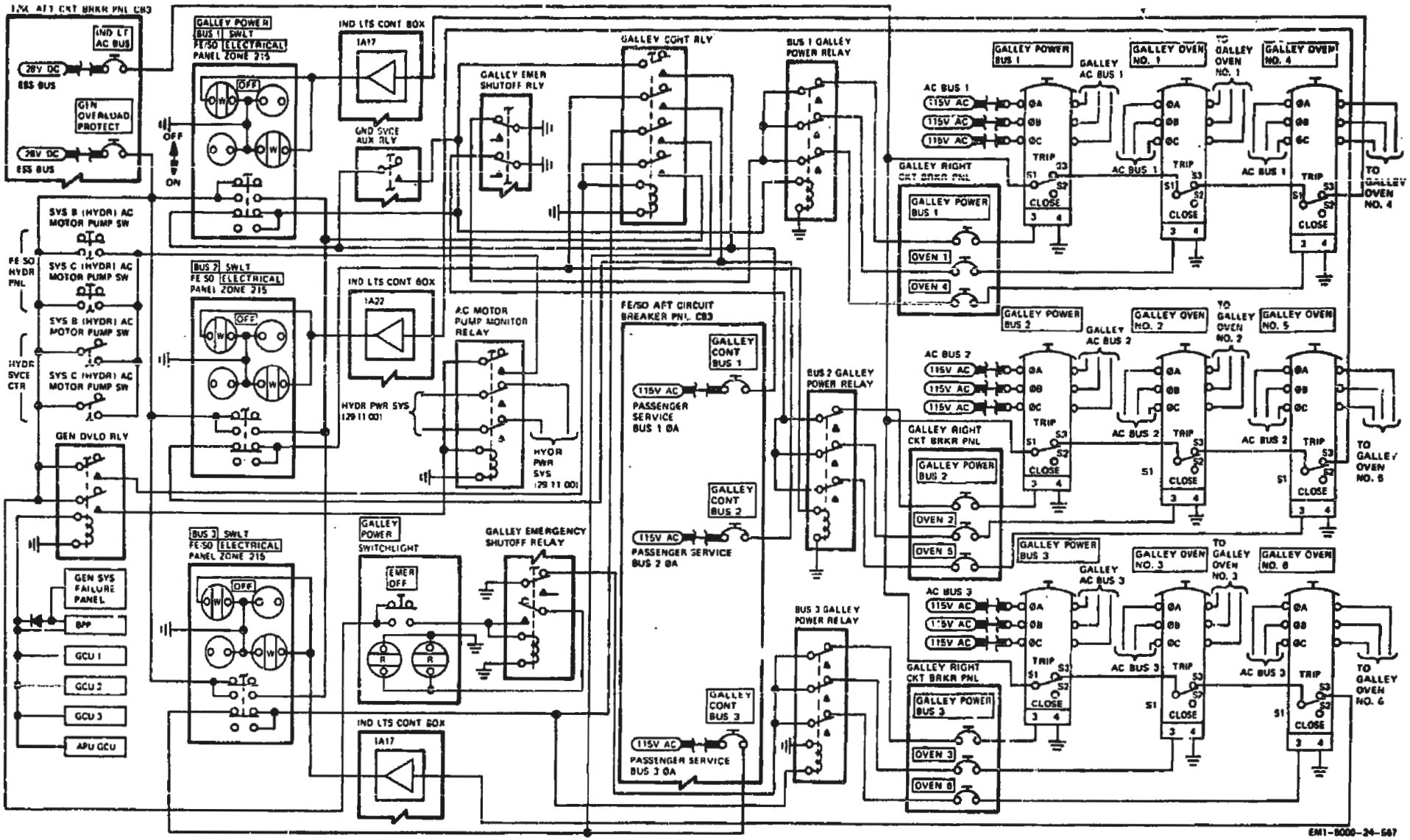
Galley Bus Control and Load Monitor System Simplified Schematic
Figure 8

R EFFECTIVITY: 001-029 WITHOUT SB24-036 AND
R SB24-044
001B



Galley Bus Control and Load Monitor System Simplified
Figure 8

R EFFECTIVITY: 001-029 WITH SB24-036 AND WITHOUT
R SB24-044
001B


AND LT AC BUS
28V DC ESS BUS
GEN OVERLOAD PROTECT
28V DC ESS BUS
GALLEY POWER BUS 1 SWLT FE/SO ELECTRICAL PANEL ZONE 215
OFF
ON
IND LTS CONT BOX 1A17
GND SVCE AUX RLY
GALLEY EMER SHUTOFF RLY
GALLEY CONT RLY
BUS 1 GALLEY POWER RELAY
SYS B (HYDR) AC MOTOR PUMP SW
SYS C (HYDR) AC MOTOR PUMP SW
SYS B (HYDR) AC MOTOR PUMP SW
SYS C (HYDR) AC MOTOR PUMP SW
FE SO HYDR PNL
HYDR SVCE CTR
BUS 2 SWLT FE SO ELECTRICAL PANEL ZONE 215
IND LTS CONT BOX 1A22
HYDR PWR SYS 129 11 001
AC MOTOR PUMP MONITOR RELAY
HYDR PWR SYS 129 11 001
FE/SO AFT CIRCUIT BREAKER PNL CB3
GALLEY CONT BUS 1
115V AC PASSENGER SERVICE BUS 1 ØA
GALLEY CONT BUS 2
115V AC PASSENGER SERVICE BUS 2 ØA
GALLEY CONT BUS 3
115V AC PASSENGER SERVICE BUS 3 ØA
BUS 2 GALLEY POWER RELAY
BUS 3 GALLEY POWER RELAY
GEN DVLO RLY
GEN SYS FAILURE PANEL
BPP
GCU 1
GCU 2
GCU 3
APU GCU
BUS 3 SWLT FE/SO ELECTRICAL PANEL ZONE 215
GALLEY POWER SWITCHLIGHT
EMER OFF
GALLEY EMERGENCY SHUTOFF RELAY
IND LTS CONT BOX 1A17
GALLEY POWER BUS 1
AC BUS 1
115V AC
GALLEY AC BUS 1
GALLEY OVEN NO. 1
TO GALLEY OVEN NO. 1
GALLEY OVEN NO. 4
TO GALLEY OVEN NO. 4
GALLEY RIGHT CKT BRKR PNL
GALLEY POWER BUS 1
OVEN 1
OVEN 4
TRIP
CLOSE
GALLEY POWER BUS 2
AC BUS 2
GALLEY AC BUS 2
GALLEY OVEN NO. 2
TO GALLEY OVEN NO. 2
GALLEY OVEN NO. 5
TO GALLEY OVEN NO. 5
GALLEY RIGHT CKT BRKR PNL
GALLEY POWER BUS 2
OVEN 2
OVEN 5
GALLEY POWER BUS 3
AC BUS 3
GALLEY AC BUS 3
GALLEY OVEN NO. 3
TO GALLEY OVEN NO. 3
GALLEY OVEN NO. 6
TO GALLEY OVEN NO. 6
GALLEY RIGHT CKT BRKR PNL
GALLEY POWER BUS 3
OVEN 3
OVEN 6
EM1-9000-24-567

Galley Bus Control and Load Monitor System Simplified Schematic
Figure 8

R
R
001B

EFFECTIVITY: 001-029 WITH SB24-036 AND SB24-044 AND 030-999

When energized with a dc signal from the generator overload relay, the relay opens the two remote controlled circuit breakers which connect three-phase power to hydraulic pumps in systems B and C. The relay locks itself in and remains so until both system B and C hydraulic AC PUMPS switchlights on the HYDRAULIC SYSTEM panel, zone 215, and both AC MOTOR PUMPS toggle switches on the hydraulic service panel, zone 147, are turned off.

D. Galley Power Emergency Shutoff Switchlight

The galley power emergency shutoff switchlight is a double-pole, double-throw unit located in the galley compartment, zone 131, just aft of the galley compartment door at FS 830 (WL 155).

When the switchlight is depressed (latched in), the galley emergency shutoff relay is energized. The relay energizes buses 1, 2, and 3 galley power relays which, in turn, remove the ground from all galley power RCCB's. The RCCB's deenergize galley ac buses 1, 2, and 3 and all galley ovens, and the OFF legend of the switchlight comes on. When the switchlight is released (out), galley power is restored.

NOTE: Whenever galley power is removed by depressing the galley power EMER OFF switchlight, the refrigerator ON/OFF and CHILL - FREEZE switchlights will remain on. The lights will go off if the REFR OVHT CONT circuit breaker on the galley left circuit breaker panel is opened.

E. Galley Emergency Shutoff Relay

The galley emergency shutoff relay is a polarized, four-pole, double-throw, 10-ampere, sealed unit that has 14 gold-over-silver-plated plug-in-type contacts. The normally open relay plugs into a prewired socket with holddown flanges on two sides in the mid electrical service center, zone 137.

When energized (Ref. Fig. 8) with 28V dc from the galley power emergency shutoff switchlight, the relay removes the control ground from the galley power and galley oven remote controlled circuit breakers, and turns on the OFF light in the galley power emergency shutoff switchlight.

F. Galley Control Circuit Breakers

The three GALLEY CONTROL circuit breakers located on the Galley Left Circuit Breaker panel, supply power to the coils of the three Galley Power Relays which, when energized, open the ground circuit to terminal 3 of the galley power RCCBs. The RCCBs then

open and remove galley power. If the Galley Control circuit breakers are open, capability to turn off galley power is impaired.

On aircraft 001-029 W/O SB24-036,
if the GALLEY CONTROL circuit breakers are opened, galley power can be removed only by opening the galley power RCCB trip/set circuit breakers on the galley Right Circuit Breaker panel.

NOTE: If one of the three GALLEY CONTROL circuit breakers are opened, pressing the Galley Power Emergency Shutoff switch will remove power from only part of the galley, but the EMER OFF indicator light in this switch will indicate complete removal of galley power.

On aircraft 001-029 WITH SB24-036 AND 030-999,
galley power can also be removed by using the Galley Power Emergency Shutoff switch.

NOTE: In all aircraft, Galley power cannot be removed using the Galley Power Switches on the Flight Engineers electrical control panel or by the automatic generator overload shedding circuit, if the Galley Control circuit breakers are open.

On aircraft 001-029 WITH SB24-044 AND 030-999,
the Galley Control Circuit Breakers are moved to the AC Essential Bus in the flight station. If these circuit breakers are opened, galley power can be removed only by opening the galley RCCB trip/set circuit breakers or by using the galley power emergency shutoff switch.

R # AC BUS SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

R If the flight crew reports a trouble using a fault code number, the code number can be found in the Fault Isolation Reference Table in the Chapter 24 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematics.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in this section.

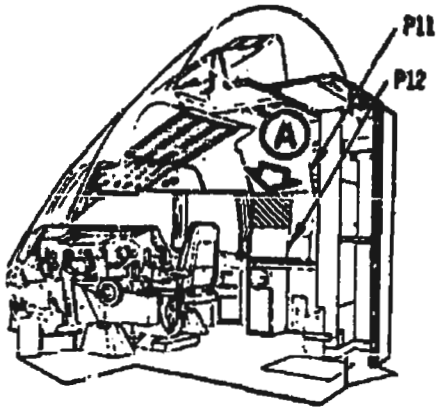
R TABLE 101

R FIGURE	TITLE
R 101	Component Location Index
R 102	Component Locator Diagram
R 103	AC Bus Extension Fault Isolation
R 104	Galley AC Bus Fault Isolation

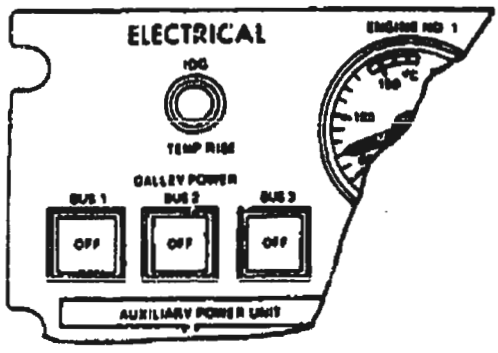
COMPONENT	QTY	AREA/ACCESS	REFERENCE
CIRCUIT BREAKERS			
GALLEY OVEN RCCB'S	6	MESC; REMOTE CONTROL CIRCUIT BREAKER BOX/ZONE 137	24-51-02
GALLEY POWER RCCB'S	3	MESC; REMOTE CONTROL CIRCUIT BREAKER BOX/ZONE 137	24-51-02
FLT STA BUS NO. 1 EXT RCCB 2451-CB26	1	MESC; REMOTE CONTROL CIRCUIT BREAKER BOX/ZONE 137	24-51-02
FLT STA BUS NO. 2 EXT RCCB 2451-CB27	1	MESC; REMOTE CONTROL CIRCUIT BREAKER BOX/ZONE 137	24-51-02
FLT STA BUS NO. 3 EXT RCCB 2451-CB28	1	MESC; REMOTE CONTROL CIRCUIT BREAKER BOX/ZONE 137	24-51-02
LAMPS – SWITCHLIGHT	2	FLIGHT ENGINEER HYDRAULIC SYSTEM PANEL	20-33-01
LAMPS – SWITCHLIGHT	3	FLIGHT ENGINEER ELECTRICAL CONTROL PANEL	20-33-01
RELAYS			
AC BUS 1 EXT FAIL RELAY (2451-K3)	1	FESC RELAY PANEL FS 190-219 R/H SIDE	20-24-01
AC BUS 2 EXT FAIL RELAY (2451-K5)	1	FESC RELAY PANEL FS 190-219 R/H SIDE	20-24-01
AC BUS 3 EXT FAIL RELAY (2451-K4)	1	FESC RELAY PANEL FS 190-219 R/H SIDE	20-24-01
AC MOTOR PUMP MONITOR RELAY (2451-K2)	1	FESC RELAY PANEL FS 190-219 R/H SIDE	20-24-01
GALLEY EMERGENCY SHUTOFF RELAY (2451-K8)	1	MESC RELAY PANEL FS 943 FWD	20-24-01
GALLEY CONTROL RELAY (2451-K3)	1	FESC RELAY PANEL FS 190-219 R/H SIDE	20-24-01
GALLEY BUS 1 POWER RELAY (2499-K7)	1	MESC RELAY PANEL FS 943 FWD	20-24-01
GALLEY BUS 2 POWER RELAY (2499-K8)	1	MESC RELAY PANEL FS 943 FWD	20-24-01
GALLEY BUS 3 POWER RELAY (2499-K9)	1	MESC RELAY PANEL FS 943 FWD	20-24-01
GENERATOR CONTROL UNITS	3	MESC, RH RACK, LH RACK/192ER-1	24-21-05
GENERATOR SYSTEM FAILURE ANNUNCIATOR PANEL	1	MESC, AFT BULKHD/192ER-1	24-20-01

M1-0001-24-848

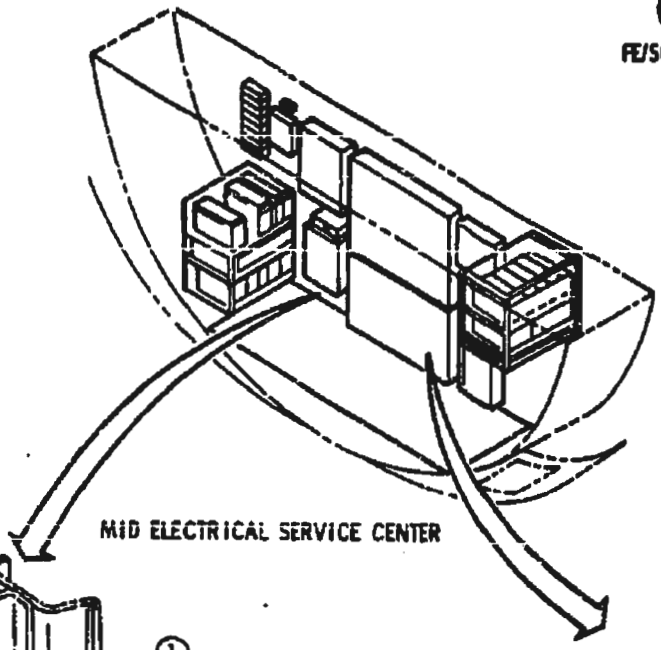
R Component Locator Index
R Figure 101



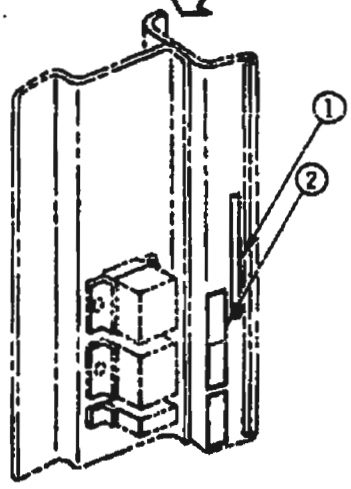
FLIGHT STATION



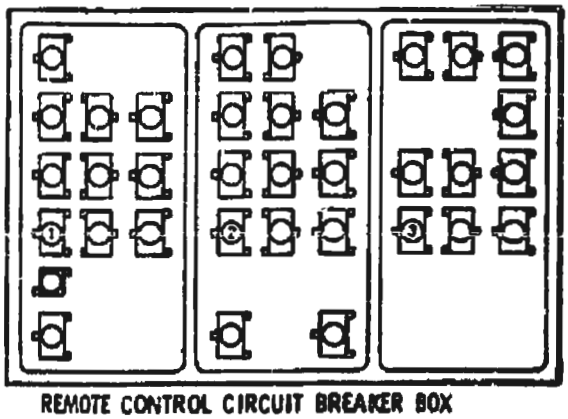
(A)
FE/SO PANEL



MID ELECTRICAL SERVICE CENTER



MESC RELAY PANEL
1. GALLEY PWR RELAYS
2. GALLEY EMER SHUTOFF RELAY

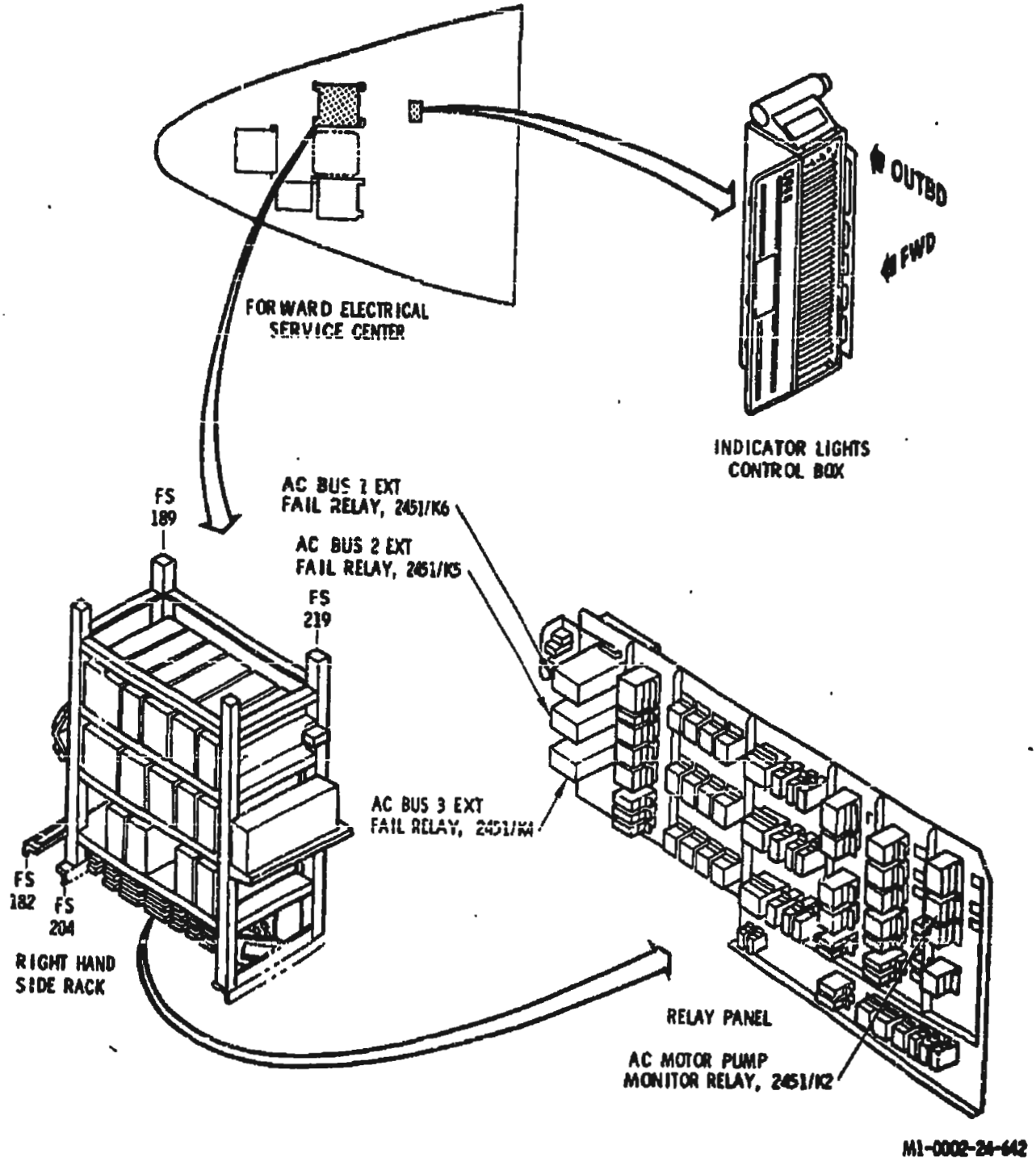


REMOTE CONTROL CIRCUIT BREAKER BOX
1. FLT STA BUS 1 EXT RCCB-CB26
2. FLT STA BUS 2 EXT RCCB-CB27
3. FLT STA BUS 3 EXT RCCB-CB28

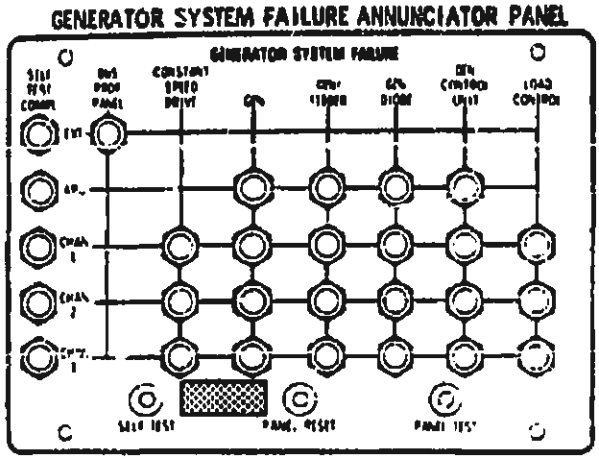
M1-0000-24-643

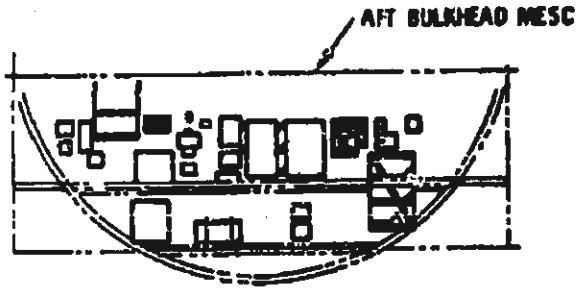
R
R

Component Locator Diagram
Figure 102 (Sheet 1)

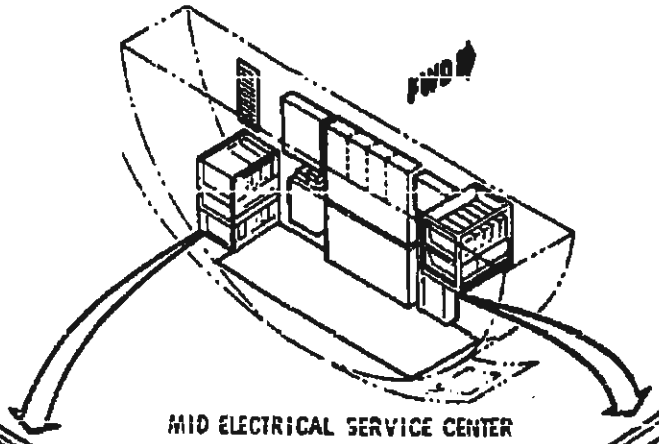


R Component Locator Diagram
R Figure 102 (Sheet 2)

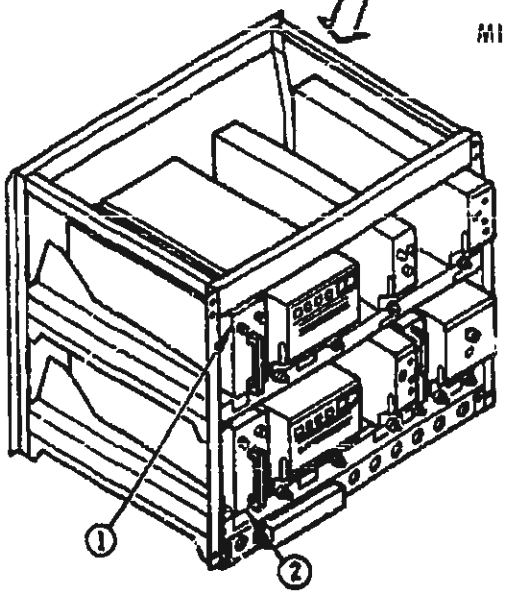




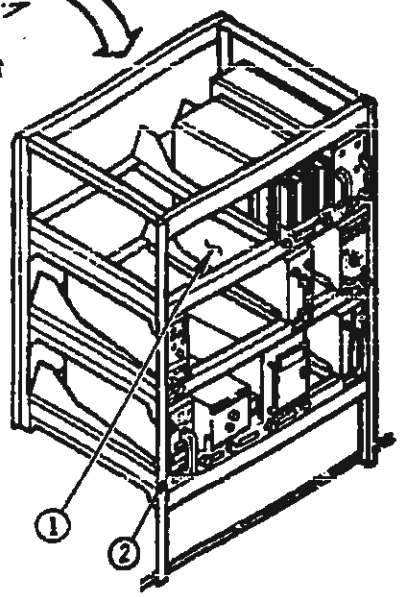
MID ELECTRICAL SERVICE CENTER
LOOKING AFT AT FS 983



MID ELECTRICAL SERVICE CENTER



MESC RIGHT HAND RACK
① NO. 2 GENERATOR CONTROL UNIT
② NO. 3 GENERATOR CONTROL UNIT



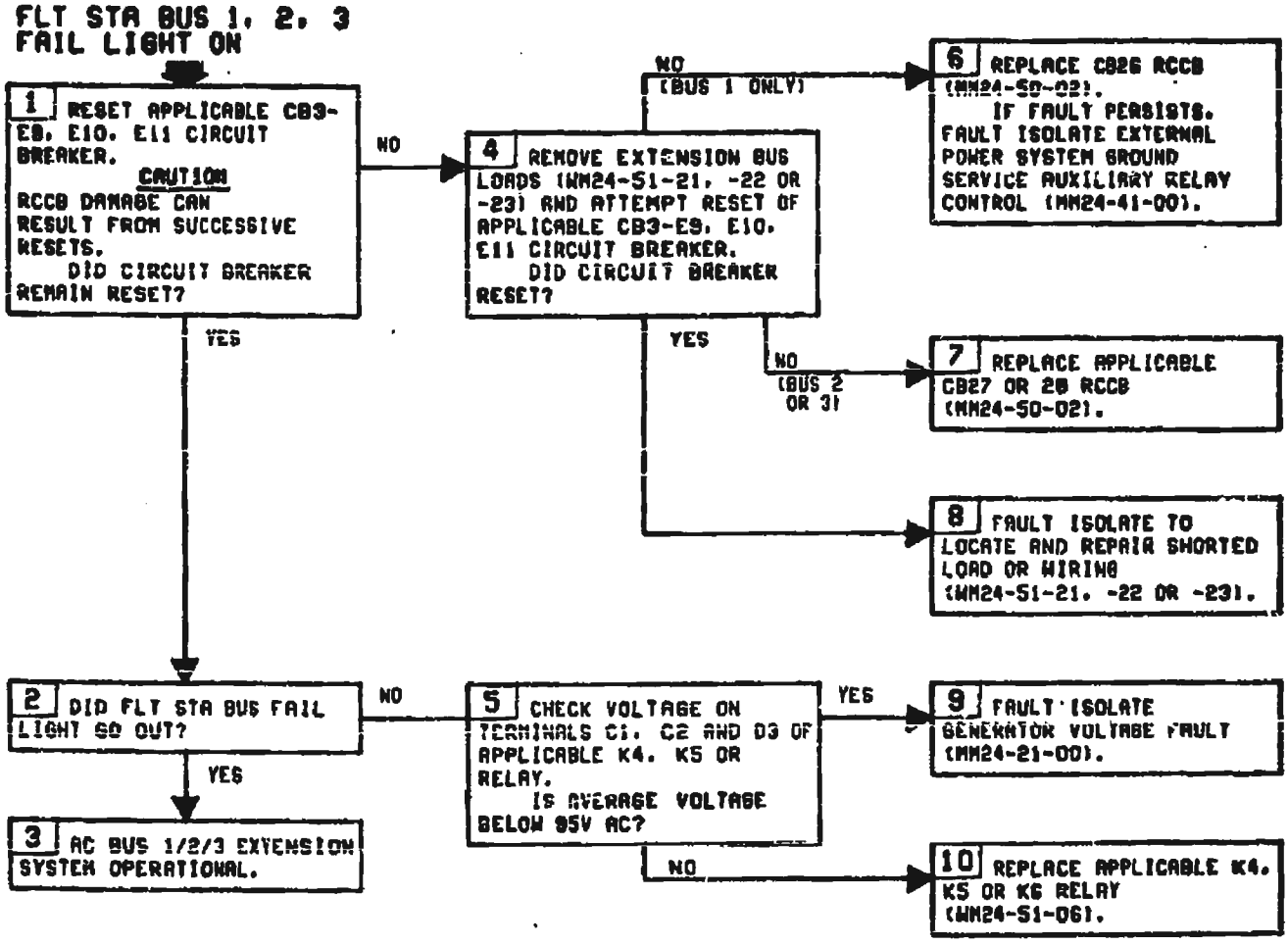
MESC LEFT HAND RACK
① NO. 1 GENERATOR CONTROL UNIT
② BUS PROTECTION PANEL

M1-0000-24-666

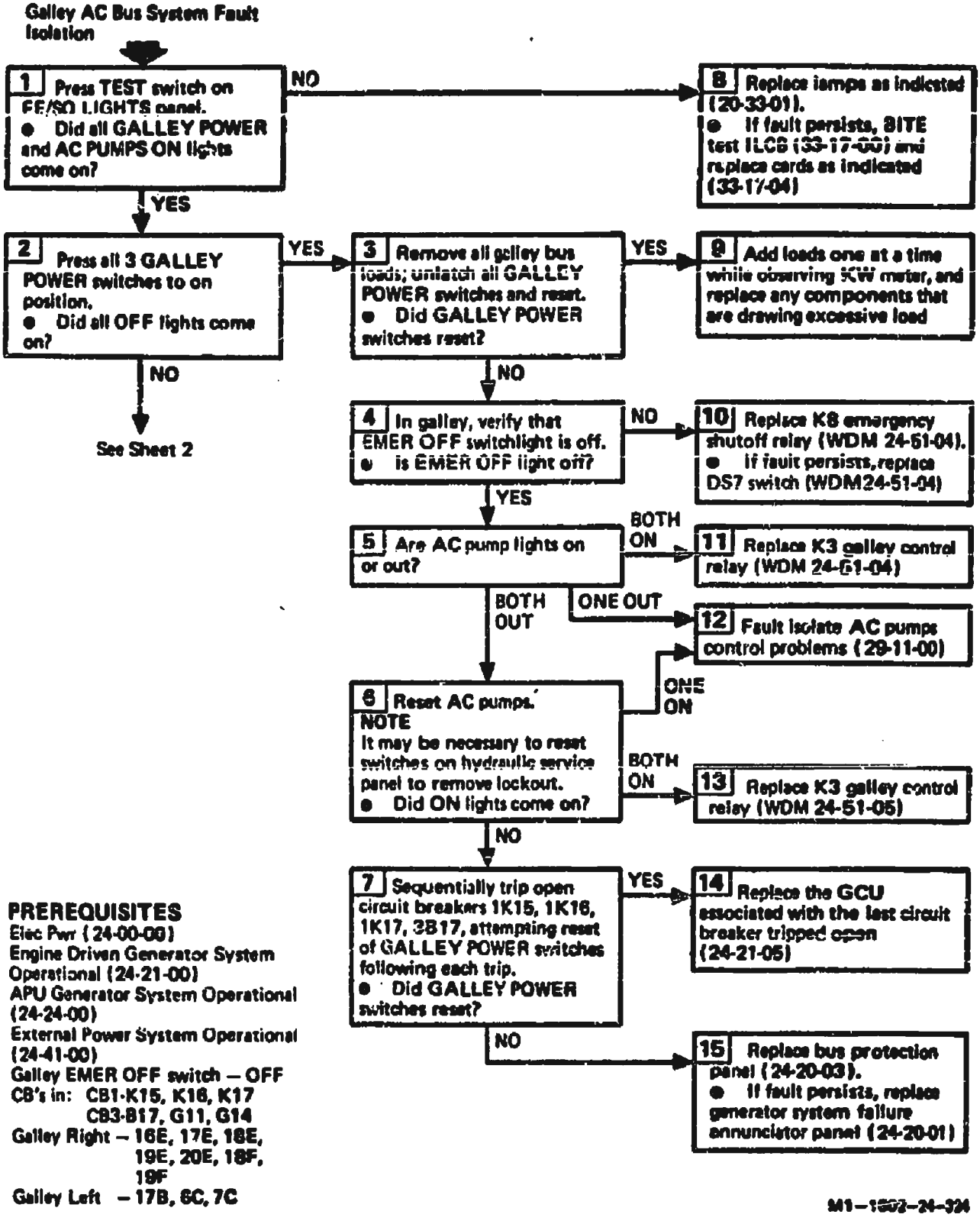
R
R Component Locator Diagram
Figure 102 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

PREREQUISITES
ELECTRICAL POWER (MM24-00-00)
ENGINE DRIVEN GENERATOR SYSTEMS OPERATIONAL (MM24-21-00)
APU GENERATOR SYSTEM OPERATIONAL (MM24-14-00)
EXTERNAL POWER SYSTEM OPERATIONAL (MM24-41-00)
CB'S IN: CB3-D10, D13, D18, E9, E10, E11, B11

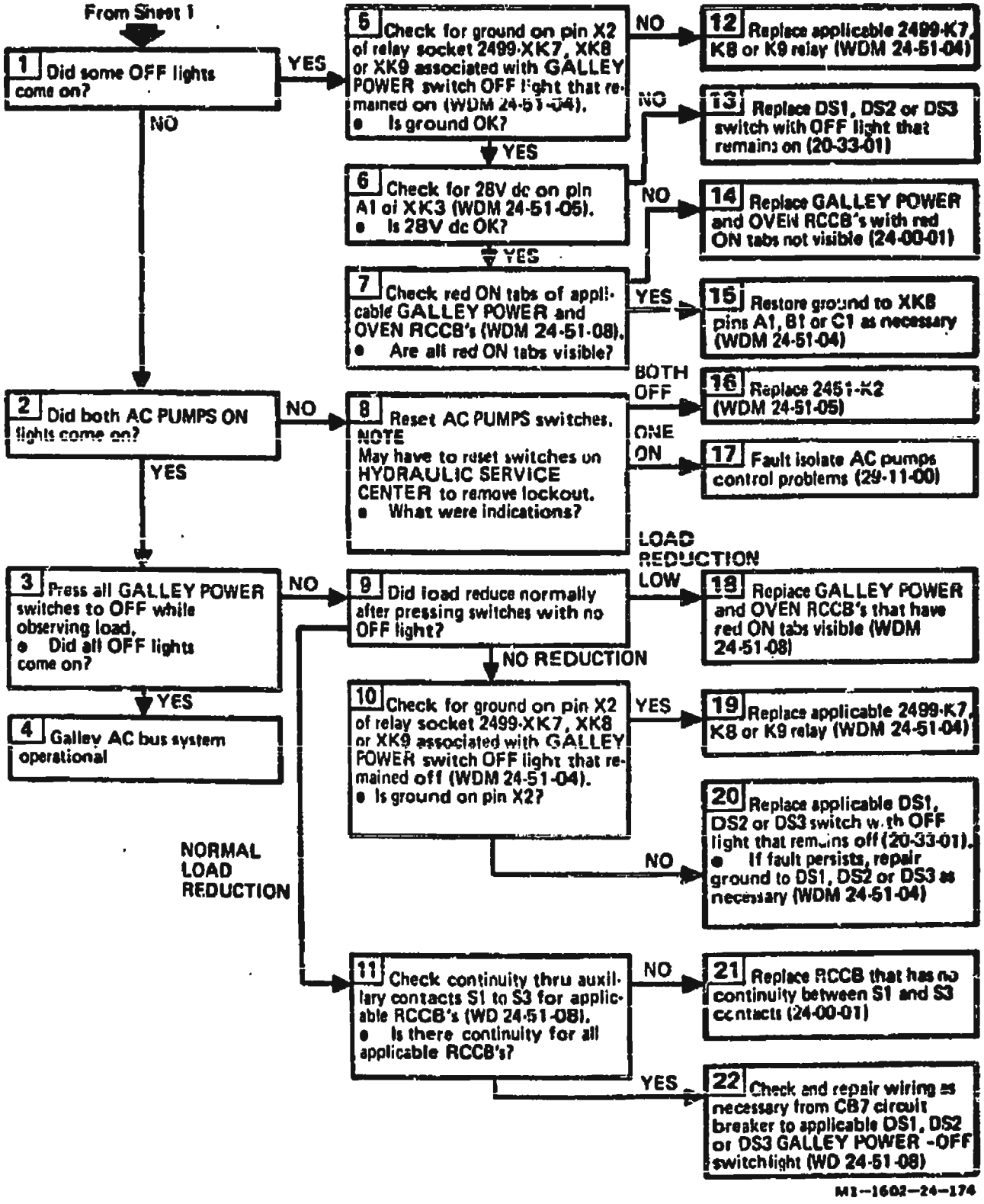

FLT STA BUS 1, 2, 3 FAIL LIGHT ON
1 RESET APPLICABLE CB3-E9, E10, E11 CIRCUIT BREAKER.
CAUTION
RCCB DAMAGE CAN RESULT FROM SUCCESSIVE RESETS.
DID CIRCUIT BREAKER REMAIN RESET?
NO
YES
2 DID FLT STA BUS FAIL LIGHT GO OUT?
NO
YES
3 AC BUS 1/2/3 EXTENSION SYSTEM OPERATIONAL.
4 REMOVE EXTENSION BUS LOADS (MM24-51-21, -22 OR -23) AND ATTEMPT RESET OF APPLICABLE CB3-E9, E10, E11 CIRCUIT BREAKER.
DID CIRCUIT BREAKER RESET?
NO (BUS 1 ONLY)
YES
NO (BUS 2 OR 3)
5 CHECK VOLTAGE ON TERMINALS C1, C2 AND D3 OF APPLICABLE K4, K5 OR RELAY.
IS AVERAGE VOLTAGE BELOW 95V AC?
YES
NO
6 REPLACE CB26 RCCB (MM24-50-02).
IF FAULT PERSISTS, FAULT ISOLATE EXTERNAL POWER SYSTEM GROUND SERVICE AUXILIARY RELAY CONTROL (MM24-41-00).
7 REPLACE APPLICABLE CB27 OR 28 RCCB (MM24-50-02).
8 FAULT ISOLATE TO LOCATE AND REPAIR SHORTED LOAD OR WIRING (MM24-51-21, -22 OR -23).
9 FAULT ISOLATE GENERATOR VOLTAGE FAULT (MM24-21-00).
10 REPLACE APPLICABLE K4, K5 OR K6 RELAY (MM24-51-06).

R
R AC Bus Extension Fault Isolation
Figure 103


Galley AC Bus System Fault Isolation
1 Press TEST switch on FE/SO LIGHTS panel.
● Did all GALLEY POWER and AC PUMPS ON lights come on?
NO
8 Replace lamps as indicated (20-33-01).
● If fault persists, BITE test ILCS (33-17-00) and replace cards as indicated (33-17-04)
YES
2 Press all 3 GALLEY POWER switches to on position.
● Did all OFF lights come on?
YES
3 Remove all galley bus loads; unlatch all GALLEY POWER switches and reset.
● Did GALLEY POWER switches reset?
YES
9 Add loads one at a time while observing KW meter, and replace any components that are drawing excessive load
NO
See Sheet 2
4 In galley, verify that EMER OFF switchlight is off.
● Is EMER OFF light off?
NO
10 Replace K8 emergency shutoff relay (WDM 24-51-04).
● If fault persists, replace DS7 switch (WDM24-51-04)
YES
5 Are AC pump lights on or out?
BOTH ON
11 Replace K3 galley control relay (WDM 24-51-04)
BOTH OUT
ONE OUT
12 Fault isolate AC pumps control problems (29-11-00)
6 Reset AC pumps.
NOTE
It may be necessary to reset switches on hydraulic service panel to remove lockout.
● Did ON lights come on?
ONE ON
BOTH ON
13 Replace K3 galley control relay (WDM 24-51-05)
NO
7 Sequentially trip open circuit breakers 1K15, 1K16, 1K17, 3B17, attempting reset of GALLEY POWER switches following each trip.
● Did GALLEY POWER switches reset?
YES
14 Replace the GCU associated with the last circuit breaker tripped open (24-21-05)
NO
15 Replace bus protection panel (24-20-03).
● If fault persists, replace generator system failure annunciator panel (24-20-01)
PREREQUISITES
Elec Pwr (24-00-00)
Engine Driven Generator System Operational (24-21-00)
APU Generator System Operational (24-24-00)
External Power System Operational (24-41-00)
Galley EMER OFF switch – OFF
CB's in: CB1-K15, K16, K17
CB3-B17, G11, G14
Galley Right – 16E, 17E, 18E, 19E, 20E, 18F, 19F
Galley Left – 17B, 6C, 7C
M1-1502-24-324

R Galley AC Bus Fault Isolation
R Figure 104 (Sheet 1)

R EFFECTIVITY: ALL
R
001B


From Sheet 1
1 Did some OFF lights come on?
YES
NO
2 Did both AC PUMPS ON lights come on?
NO
YES
3 Press all GALLEY POWER switches to OFF while observing load.
• Did all OFF lights come on?
YES
4 Galley AC bus system operational
6 Check for ground on pin X2 of relay socket 2499-XK7, XK8 or XK9 associated with GALLEY POWER switch OFF light that remained on (WDM 24-51-04).
• Is ground OK?
NO
12 Replace applicable 2499-K7, K8 or K9 relay (WDM 24-51-04)
YES
6 Check for 28V dc on pin A1 of XK3 (WDM 24-51-05).
• Is 28V dc OK?
NO
13 Replace DS1, DS2 or DS3 switch with OFF light that remains on (20-33-01)
YES
7 Check red ON tabs of applicable GALLEY POWER and OVEN RCCB's (WDM 24-51-08).
• Are all red ON tabs visible?
NO
14 Replace GALLEY POWER and OVEN RCCB's with red ON tabs not visible (24-00-01)
YES
15 Restore ground to XK8 pins A1, B1 or C1 as necessary (WDM 24-51-04)
8 Reset AC PUMPS switches.
NOTE
May have to reset switches on HYDRAULIC SERVICE CENTER to remove lockout.
• What were indications?
BOTH OFF
16 Replace 2451-K2 (WDM 24-51-05)
ONE ON
17 Fault isolate AC pumps control problems (29-11-00)
9 Did load reduce normally after pressing switches with no OFF light?
LOAD REDUCTION LOW
18 Replace GALLEY POWER and OVEN RCCB's that have red ON tabs visible (WDM 24-51-08)
NO REDUCTION
10 Check for ground on pin X2 of relay socket 2499-XK7, XK8 or XK9 associated with GALLEY POWER switch OFF light that remained off (WDM 24-51-04).
• Is ground on pin X2?
YES
19 Replace applicable 2499-K7, K8 or K9 relay (WDM 24-51-04)
NO
20 Replace applicable DS1, DS2 or DS3 switch with OFF light that remains off (20-33-01).
• If fault persists, repair ground to DS1, DS2 or DS3 as necessary (WDM 24-51-04)
NORMAL LOAD REDUCTION
11 Check continuity thru auxiliary contacts S1 to S3 for applicable RCCB's (WD 24-51-08).
• Is there continuity for all applicable RCCB's?
NO
21 Replace RCCB that has no continuity between S1 and S3 contacts (24-00-01)
YES
22 Check and repair wiring as necessary from CB7 circuit breaker to applicable DS1, DS2 or DS3 GALLEY POWER -OFF switchlight (WD 24-51-08)
M1-1602-24-174

R Galley AC Bus Fault Isolation
R Figure 104 (Sheet 2)

R EFFECTIVITY: ALL
R
001B

MAIN AC POWER DISTRIBUTION AND REMOTE CONTROL CIRCUIT BREAKER BOX INSPECTION AND CHECK

1. Inspection and check of flexible bus terminal lugs for condition and security.

A. AC Tie Bus Compartment

WARNING: REMOVE ELECTRICAL POWER FROM AIRCRAFT TO ENSURE AGAINST ARCING, INJURY TO PERSONNEL, AND DAMAGE TO EQUIPMENT (REF. MAINTENANCE MANUAL 24-00-00).

(1) Gain access to Mid Electrical Service Center (MESC), zone 137, and locate ac tie bus compartment located just below main ac power distribution box on forward bulkhead.

(2) Open ac tie bus compartment cover.

(3) Locate flexible bus terminal lugs, where they attach to ac tie bus, and remove lug fastener protective plastic
R covers to expose terminal lugs.

R NOTE: The plastic cover can be removed by sliding end
R clip from cover and moving cover along the wire
R to expose two fasteners (on aircraft 001-003
R without SB24-088), 1/4-inch bolts and nuts (on
R aircraft 001-033 with SB24-088 and 034-999).

(4) Inspect bus terminal lugs for heat discoloration.

(a) If heat discoloration is present, disconnect terminal lug by removing two fasteners. Clean the discolored parts using a non-flammable, non-corrosive cleaner and a scrubbing pad such as 3M Scotchbrite or equivalent.

CAUTION: TO PREVENT POSSIBLE MISCONNECTION OF WIRING, EACH BUS TERMINAL LUG CONNECTION MUST BE
R COMPLETE BEFORE PROCEEDING TO THE NEXT.

R (b) On aircraft 001-033 with SB24-088, and 034-999,
R reinstall the termination 1/4-inch bolts with a
R torque wrench and tighten the bolts to 60-75
R inch-pounds.

(5) Inspect bus terminal lugs for loose fasteners and damaged bus bars, resulting from arcing.

(a) If bus bar is damaged due to arcing, replace bus bar.

R (b) On aircraft 001-033 with SB24-088, and 034-999, if only loose fasteners are encountered, retorque to 60-75 inch-pounds.

(6) Place plastic cover over each of flexible bus terminal lugs that were removed or retorqued and install end clip over cover.

(7) Close ac tie bus compartment cover.

B. Remote Control Circuit Breaker Box (RCCB)

(1) Locate RCCB box on the forward bulkhead of MESC and open three RCCB box doors.

(2) Locate flexible bus terminal lugs, where they attach to ac buses 1, 2 and 3.

(3) Inspect bus terminal lugs for heat discoloration.

(a) If present, disconnect terminal lug by removing two fasteners. Clean discolored parts using a non-flammable, non-corrosive cleaner, and a scrubbing pad, such as 3M Scotchbrite or equivalent.

CAUTION: TO PREVENT POSSIBLE MISCONNECTION OF WIRING, EACH BUS TERMINAL LUG CONNECTION MUST BE R COMPLETE BEFORE PROCEEDING TO THE NEXT.

R (b) On aircraft 001-033 with SB24-088, and 034-999, R reinstall two fasteners and torque to 60-75 R inch-pounds.

(4) Inspect bus terminal lugs for loose fasteners and damaged bus bars resulting from arcing.

(a) If bus bar is damaged due to arcing, replace bus R bar.

R (b) On aircraft 001-033 with SB24-088, and 034-999, R if only loose fasteners are encountered retorque R to 60-75 in-pounds.

(5) Close RCCB box doors.

(6) Restore electrical power (Ref. MM 24-00-00).

GENERATOR OVERLOAD RELAY - ADJUSTMENT AND TEST

1. Referenced Procedure

   24-41-00 External Power/Ground Service System - Adjustment and Test

2. Adjustment/Test

   A. Operational Test

      (1) Energize electrical system (Ref. 24-41-00).

      (2) On ELECTRICAL PANEL, zone 215, verify that the OFF light in each GALLEY POWER switchlight is illuminated.

      (3) Press all three GALLEY POWER switchlights to ON (latched in) position and verify that the OFF lights extinguish.

      NOTE: All three GALLEY POWER switchlights must be latched in to ensure validity of test.

      (4) Enter mid electrical service center (MESC) zone 137, through MESC access door FS 943 from galley or through access doors 192K and 137AZ from exterior of aircraft.

R WARNING: INJURY TO PERSONNEL OR DAMAGE to EQUIPMENT CAN
R OCCUR IF PERSONNEL AND EQUIPMENT ARE NOT CLEARED
R FROM ALL TRAVEL AREAS OF ALL FLIGHT CONTROL
R SURFACES AND MAIN GEAR DOORS BEFORE OPERATING THE
R SELF TEST SWITCH.

WARNING: WHEN THE SELF TEST SWITCH IS PRESSED, THE GENERATOR OVERLOAD RELAY ENERGIZES FOR A CHECK OF THE LOAD-SHEDDING CIRCUITS. IF THE GALLEY POWER CIRCUITS AND/OR THE AC HYDRAULIC PUMP CIRCUITS ARE ENERGIZED, THESE CIRCUITS WILL DEENERGIZE AND LOCK OUT UNTIL THEIR RESPECTIVE CONTROL SWITCHES ARE PLACED IN THE OFF POSITION.

      (5) On the GENERATOR SYSTEM FAILURE panel, momentarily press the SELF TEST switch.

      (6) Verify that OFF light in each depressed GALLEY POWER switchlight illuminates.

      (7) Release (unlatch) each GALLEY POWER switchlight and verify that OFF lights remain on.

(8) Restore galley power by placing GALLEY POWER switchlights in ON (latched in) position. Verify that OFF lights in each switchlight EXTINGUISH.

(9) Release (unlatch) GALLEY POWER switchlights.

(10) Deenergize aircraft electrical system (Ref. 24-41-00).

(11) Close and secure entry doors.

DC BUS SYSTEM - DESCRIPTION AND OPERATION

1. General

The dc bus system consists of:

DC buses 1, 2, and 3

DC ground service bus and its galley extension.

No. 2 dc radio bus

Common tie bus

Other dc buses are covered in their respective sections.

The dc bus system furnishes 28-volt power to circuit breakers in the flight station and galley areas.

A. DC Buses 1, 2, and 3

DC buses 1, 2, and 3 (Ref. Fig. 1) are energized from transformer-rectifiers (TR) No. 1, 2, and 3, respectively, to energize circuits originating in the flight station. The buses are deenergized when the ground service system is in use.

B. DC Ground Service Bus

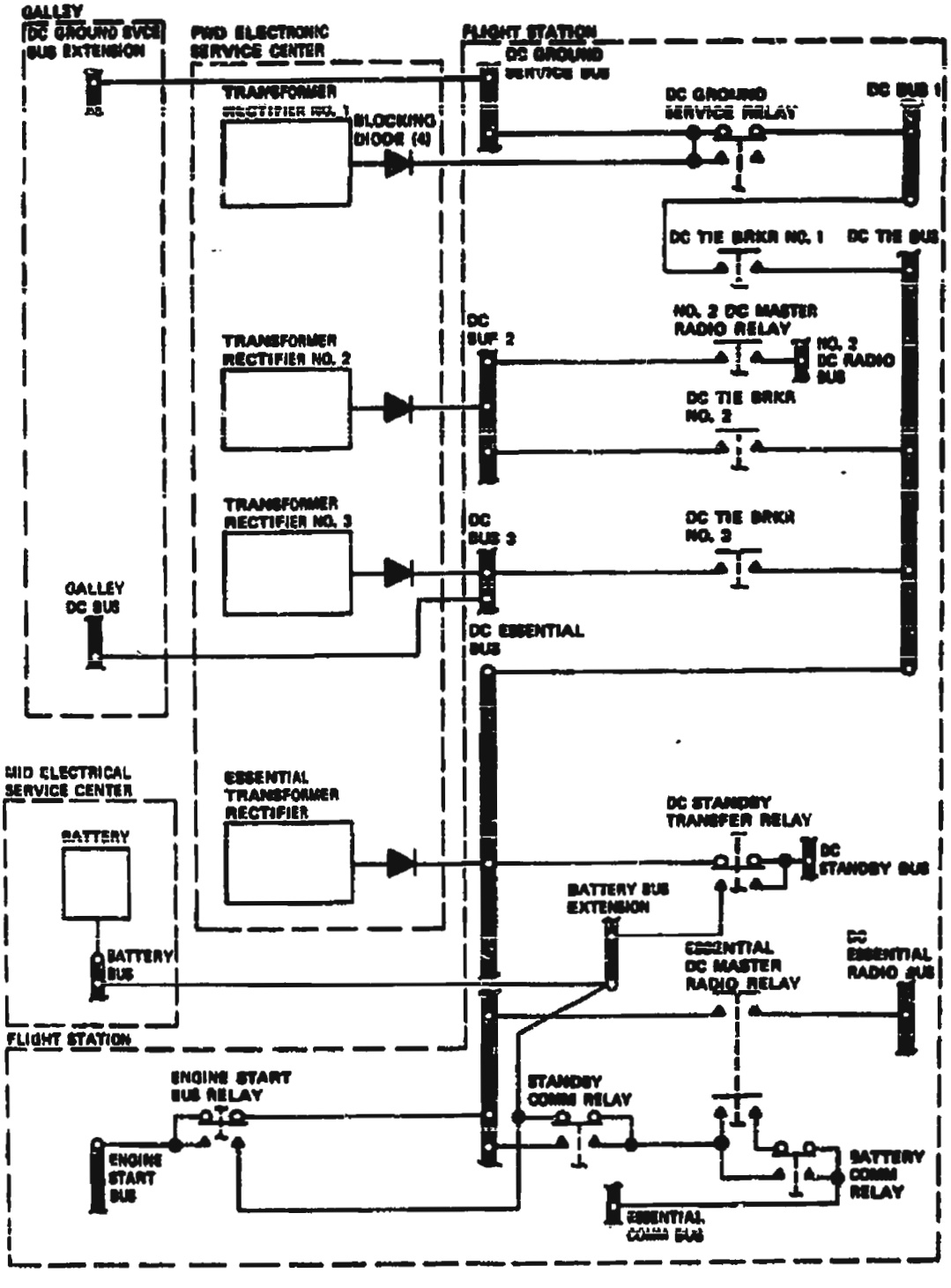
The dc ground service bus (Ref. Fig. 1) and its galley extension distribute power to the flight station and galley circuit breakers when the ground service system is in use. The buses are energized directly from TR1 through a blocking diode.

C. No. 2 DC Radio Bus

The No. 2 dc radio bus (Ref. Fig. 1) provides dc bus 2 power to energize HF and VHF communications, navigation, and other systems. The systems are energized through circuit breakers in the flight station whenever the No. 2 dc master radio relay is energized.

D. DC Tie Bus

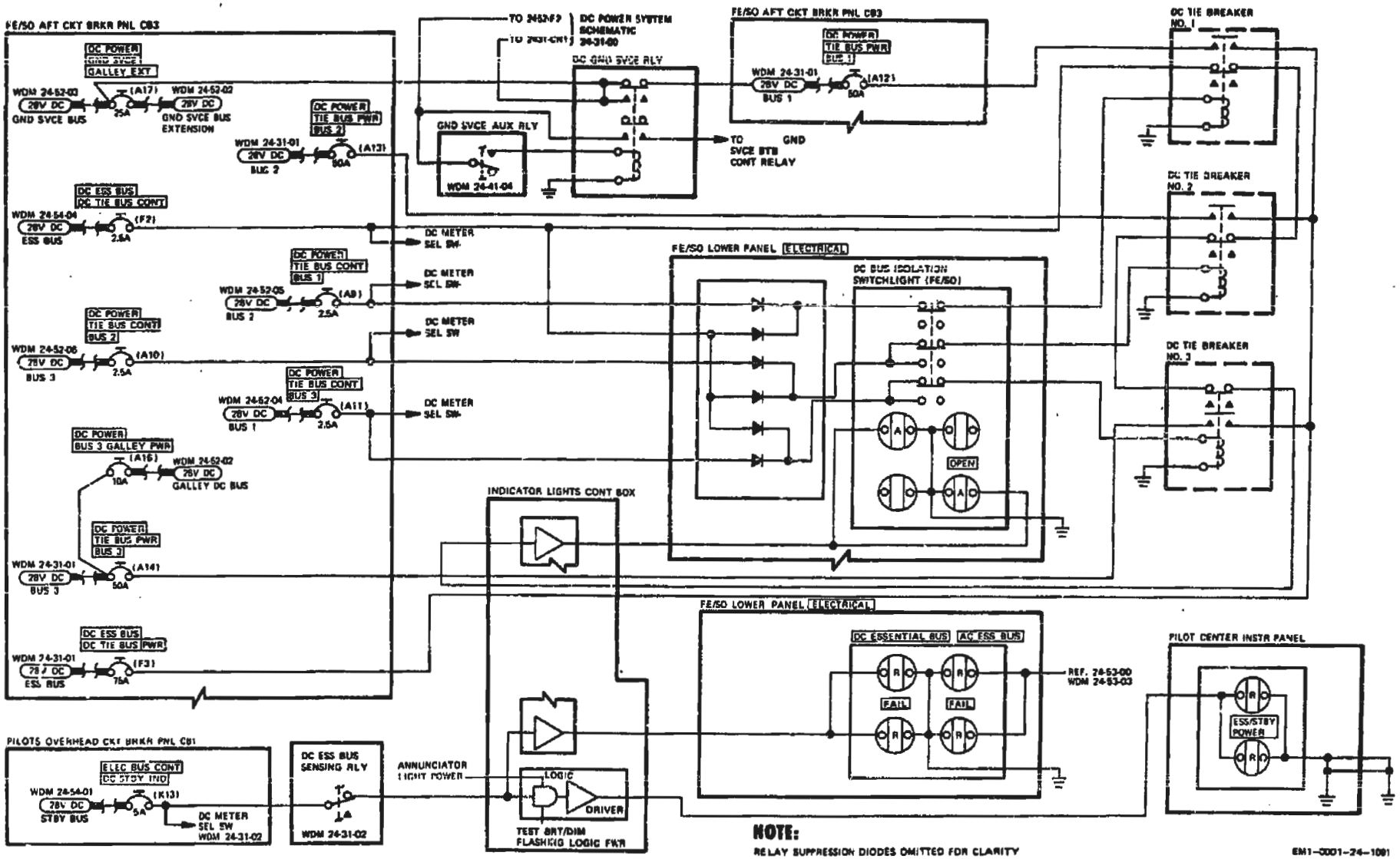
R The dc tie bus (Ref. Fig. 2) provides a means of tying together dc buses 1, 2, 3, and the dc essential bus through operation of the bus tie breakers. This permits energizing the four buses when any or all TR units are operative.



EM1-0001-24-1024

R DC Bus Distribution Simplified Schematic
R Figure 1

EFFECTIVITY: ALL



DC Tie Bus Schematic
Figure 2

EFFECTIVITY: ALL

001B

2. DC Bus Tie Breaker Relay

A. Description and Operation

R The dc bus tie breaker relay is a 50-ampere, single-pole, single-throw unit. The relay has, in addition to the main 50-ampere contacts, one set of single-pole, double-throw auxiliary contacts. Three relays are used in the dc system to parallel the four main dc buses. The relays are located in the Flight Engineer/Second Officers aft circuit breaker panel area, zone 215.

The relays operate in parallel and are energized whenever the DC BUS ISOLATION switchlight on the Flight Engineer/Second Officers electrical control panel, zone 215, is released (out). When the switchlight is depressed (latched in), the OPEN legend comes on, and the dc buses are isolated.

AC ESSENTIAL AND STANDBY BUS SYSTEM - DESCRIPTION AND OPERATION

1. General

The ac essential and standby bus system consists of the ac essential bus, the essential ac radio bus, and the ac standby bus. The buses are located on circuit breaker panels in the flight station, zones 210 and 215.

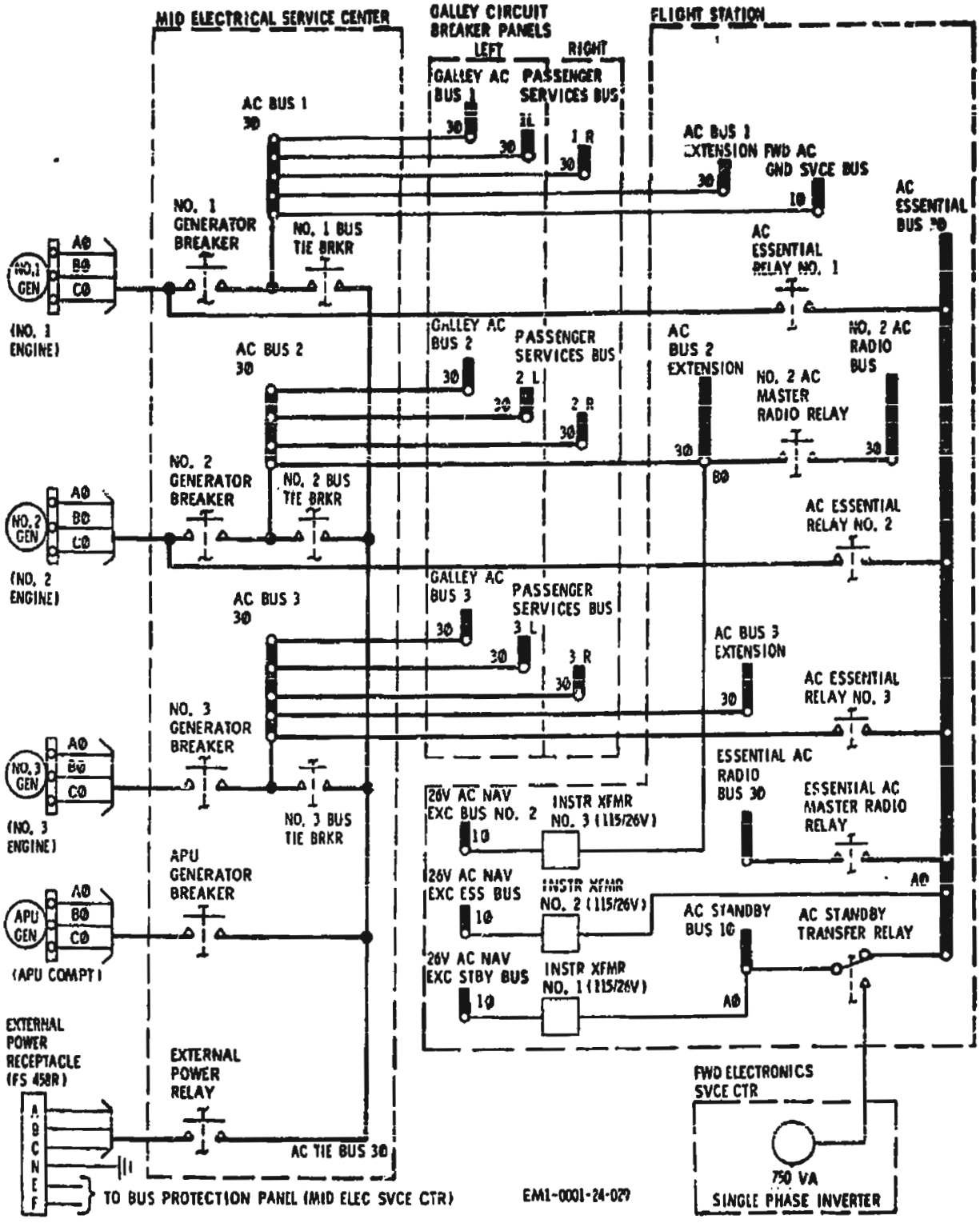
The ac essential bus system includes the bus and three ac essential relays located in the center overhead ceiling area, zone 214. Also included are two ac source relays, and an ac essential bus sensing relay located on the Flight Engineer/Second Officers relay panel, zone 215. An ac essential bus selector switch and two indicator lights are located on the Flight Engineer/Second Officers electrical control panel, zone 215. The indicator lights are identified as AC ESS BUS FAIL and ESS AC ON ALTN (amber).

The ac essential bus (Ref. Fig. 1) energizes selected essential loads which require three-phase ac power. The bus is normally energized from ac bus 3, but is automatically transferable to other sources under certain conditions. The bus is manually transferable to ac bus 3, or to generator No. 1 or 2 by manual rotation of the ac essential bus selector switch.

The essential ac radio bus system includes the bus and the essential ac master radio relay.

The three-phase bus (Ref. Fig. 1) and the relay are located in the center overhead relay area, zone 214. The bus provides ac power to the HF communications No. 1, distance measuring equipment, voice recorder, weather radar, and other systems. The bus is energized through contacts of the energized three-phase relay. The relay is energized by depressing (latched in) the MASTER RADIO ESSENTIAL switchlight on the pilots overhead panel, zone 214.

The ac standby bus system includes the bus and the ac standby transfer relay (Ref. 24-32-00). The relay is located in the center overhead relay area, zone 214. The single-phase ac standby bus (Ref. Fig. 1) is located in the overhead ceiling area, zone 216, and distributes power to flight instruments, navigation, engine ignition, N3 tachometer, turbine gas temperature indicating systems, ac standby bus sensing, and other systems. The ac standby bus is normally energized from phase A of the ac essential bus through contacts of the deenergized ac standby transfer relay. The relay is energized with single-phase inverter output whenever the inverter is energized. The STANDBY POWER/INSTR & RADIO switch on the


MID ELECTRICAL SERVICE CENTER
GALLEY CIRCUIT BREAKER PANELS
LEFT
RIGHT
FLIGHT STATION
GALLEY AC BUS 1
PASSENGER SERVICES BUS
AC BUS 1
AC BUS 1 EXTENSION
FWD AC GND SVCE BUS
AC ESSENTIAL BUS
NO. 1 GENERATOR BREAKER
NO. 1 BUS TIE BRKR
AC ESSENTIAL RELAY NO. 1
NO. 1 GEN
(NO. 1 ENGINE)
GALLEY AC BUS 2
PASSENGER SERVICES BUS
AC BUS 2
AC BUS 2 EXTENSION
NO. 2 AC RADIO BUS
NO. 2 AC MASTER RADIO RELAY
NO. 2 GENERATOR BREAKER
NO. 2 BUS TIE BRKR
AC ESSENTIAL RELAY NO. 2
NO. 2 GEN
(NO. 2 ENGINE)
GALLEY AC BUS 3
PASSENGER SERVICES BUS
AC BUS 3
AC BUS 3 EXTENSION
AC ESSENTIAL RELAY NO. 3
NO. 3 GENERATOR BREAKER
NO. 3 BUS TIE BRKR
ESSENTIAL AC RADIO BUS 30
ESSENTIAL AC MASTER RADIO RELAY
NO. 3 GEN
(NO. 3 ENGINE)
26V AC NAV EXC BUS NO. 2
INSTR XFMR NO. 3 (115/26V)
APU GENERATOR BREAKER
26V AC NAV EXC ESS BUS
INSTR XFMR NO. 2 (115/26V)
AC STANDBY BUS 10
AC STANDBY TRANSFER RELAY
APU GEN
(APU COMPT)
26V AC NAV EXC STBY BUS
INSTR XFMR NO. 1 (115/26V)
EXTERNAL POWER RECEPTACLE (FS 458R)
EXTERNAL POWER RELAY
AC TIE BUS 30
FWD ELECTRONICS SVCE CTR
750 VA SINGLE PHASE INVERTER
TO BUS PROTECTION PANEL (MID ELEC SVCE CTR)
EM1-0001-24-029

R AC Bus Distribution System Simplified Schematic
R Figure 1

EFFECTIVITY: ALL

eyebrow panel, zone 210, is placed in the ON position to energize the inverter. The inverter is energized automatically in the event of a failure of the ac essential bus. This occurs when the BATTERY switch on the Flight Engineer/Second Officers electrical control panel, zone 215, is in the ON position and the STANDBY POWER INSTR & RADIO switch is in the ARM position.

2. Operation

A. AC Essential Bus

The three-phase ac essential bus (Ref. Fig. 1) is normally energized from ac bus 3. The bus is energized through the bus 3 ac essential bus power remote controlled circuit breaker in the mid electrical service center, zone 137, and through contacts of the ac essential relay No. 3. Alternate power sources are selected automatically or manually, depending on the positioning of the ac essential bus selector switch (Ref. Fig. 2).

With the ac essential bus selector switch in the NORM B3-(G1) position, 28V dc energizes ac essential relay No. 3. The energizing circuit is from the dc standby bus, through the AC ESS BUS CONT circuit breaker on the pilots overhead circuit breaker panel CB1, zone 210, and an isolation diode, or from the dc essential bus through the AC BUS IND circuit breaker on the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, and an isolation diode. The circuit continues through contacts of the selector switch, through contacts of the deenergized ac source 3 relay, through contacts of deenergized ac essential relays No. 1 and 2, and to the No. 3 relay coil. With the relay energized, the relay connects the ac essential bus to ac bus 3 (its normal power source). Operation of the essential bus system in the NORM and failed-to-alternate modes are shown in Figure 3.

With a failure of ac bus 3, the ac bus 3 extension-fail indication relay (Ref. Fig. 3) energizes the ac source 3 relay. After a 2-second time delay, the energized ac source 3 relay transfers power to the coil of essential ac relay No. 1, through contacts of deenergized essential relays No. 2 and 3, and the ac source 1 relay. Essential ac relay No. 1, when energized, restores three-phase power directly from generator No. 1 to the ac essential bus. The energized ac source 3 relay connects dc power to the ESS AC ON ALTN indicator light on the Flight Engineer/Second Officers electrical control panel, zone 215. The light comes on to indicate that the ac essential bus normal power source has failed, and that the bus is being energized from an

alternate source. In this case, the alternate source is generator No. 1.

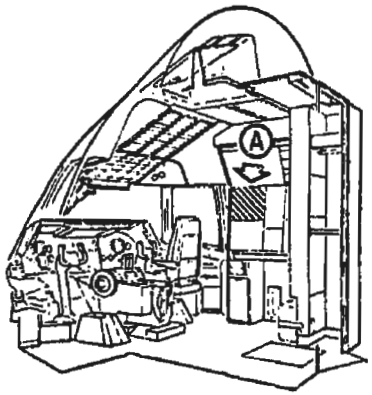
With the ac essential bus selector switch in the B3(G2) position, the normal power source for the bus is ac bus 3. If ac bus 3 fails, the bus automatically transfers directly to generator No. 2 and the ESS AC ON ALTN indicator light comes on. The B3(G2) normal and failure modes are shown in Figure 4.

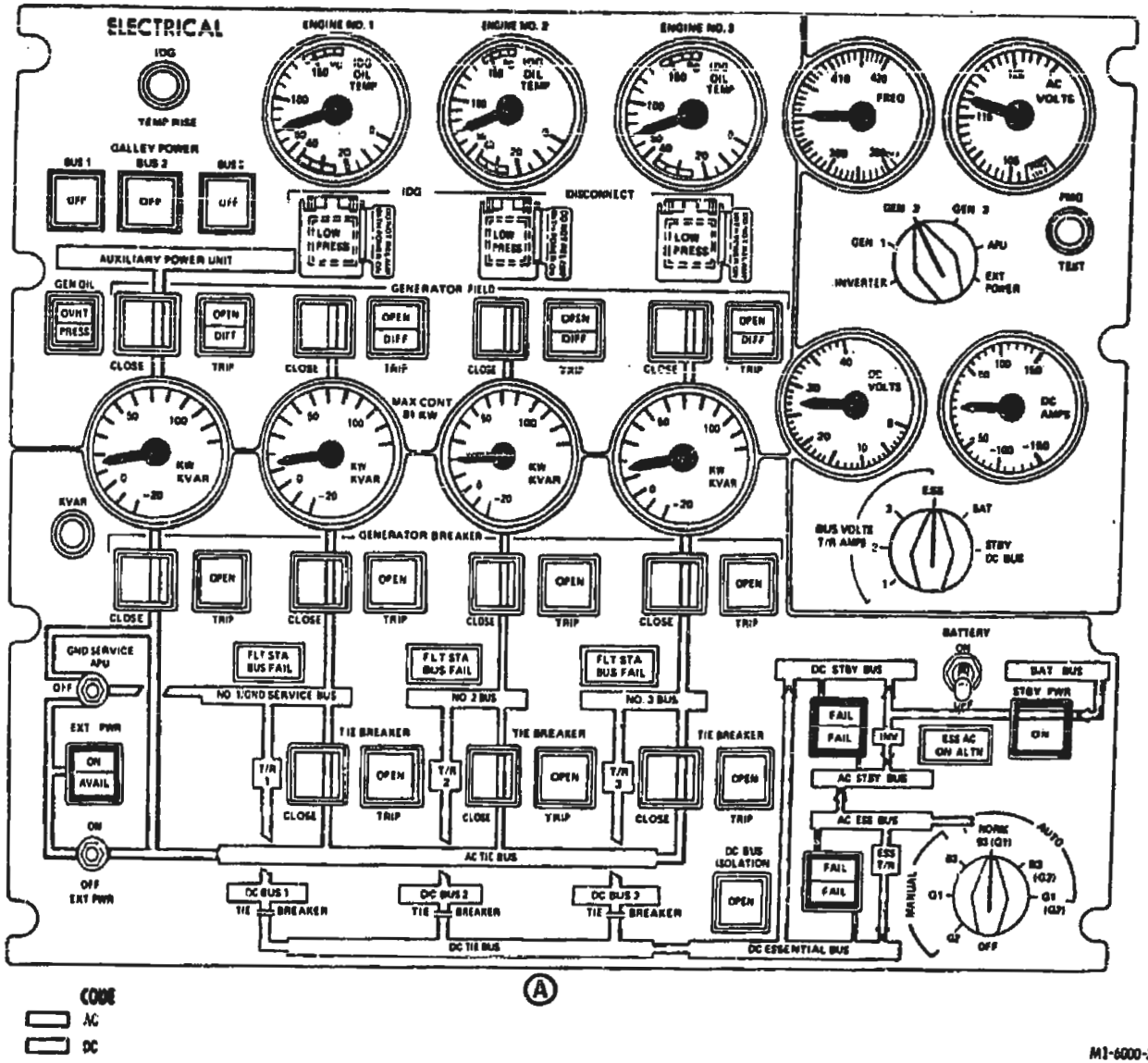
With the ac essential bus selector switch in the G1(G2) position, the normal power source for the bus is generator No. 1. If generator No. 1 fails, ac source 1 relay deenergizes and transfers dc control power to ac essential relay No. 2. This condition energizes the ac essential bus directly from generator No. 2, and causes the ESS AC ON ALTN indicator light to come on. The G1(G2) normal and failure modes are shown in Figure 5.

NOTE: When the ac essential bus selector switch is in one of the automatic positions, B3-(G1), B3(G2), or G1(G2), and the selected primary source fails, the bus automatically transfers to the secondary or alternate source. When power is restored to the primary source, the bus automatically transfers back to the primary source.

With the ac essential bus selector switch in the B3 position, the only power source for the bus is ac bus 3. In this position, automatic transfer is not provided. DC standby bus power (or dc essential bus power) is routed through the selector switch, through contacts of deenergized ac essential relays No. 1 and 2, to energize ac essential relay No. 3. If ac bus 3 fails, the G1 (or G2) position must be selected. In this case, the system is independent of the dc standby bus (and the dc essential bus), and the ac essential bus is energized directly from the No. 1 (or No. 2) generator. The B3 and G1 operating modes are shown in Figure 6.

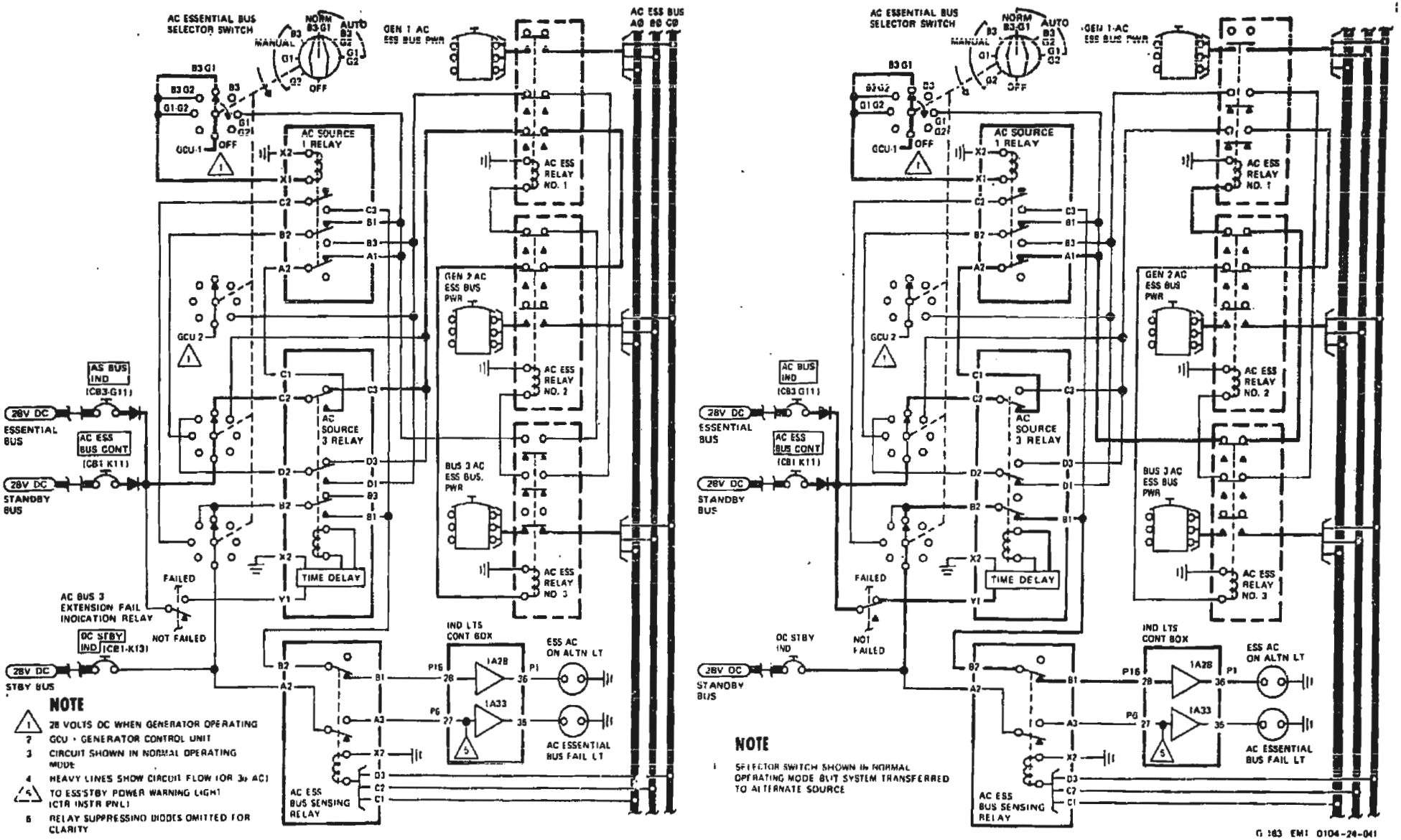
When the ac essential bus selector switch is placed in the G2 position, the operation is similar to the G1 position. The ac essential relay No. 2 is energized with dc power from the No. 2 generator control unit. The circuit is completed through the selector switch, and through contacts of deenergized ac essential relays No. 1 and 3. In this condition, generator No. 2 becomes an independent power source both for energizing and controlling the ac essential bus as shown in Fig. 7. If generator No. 2 fails, the G1 or B3 position must be selected. The bus system condition with the selector switch in the OFF position is shown in Figure 7. A complete failure of the ac essential bus causes the AC





M1-6000-24-096

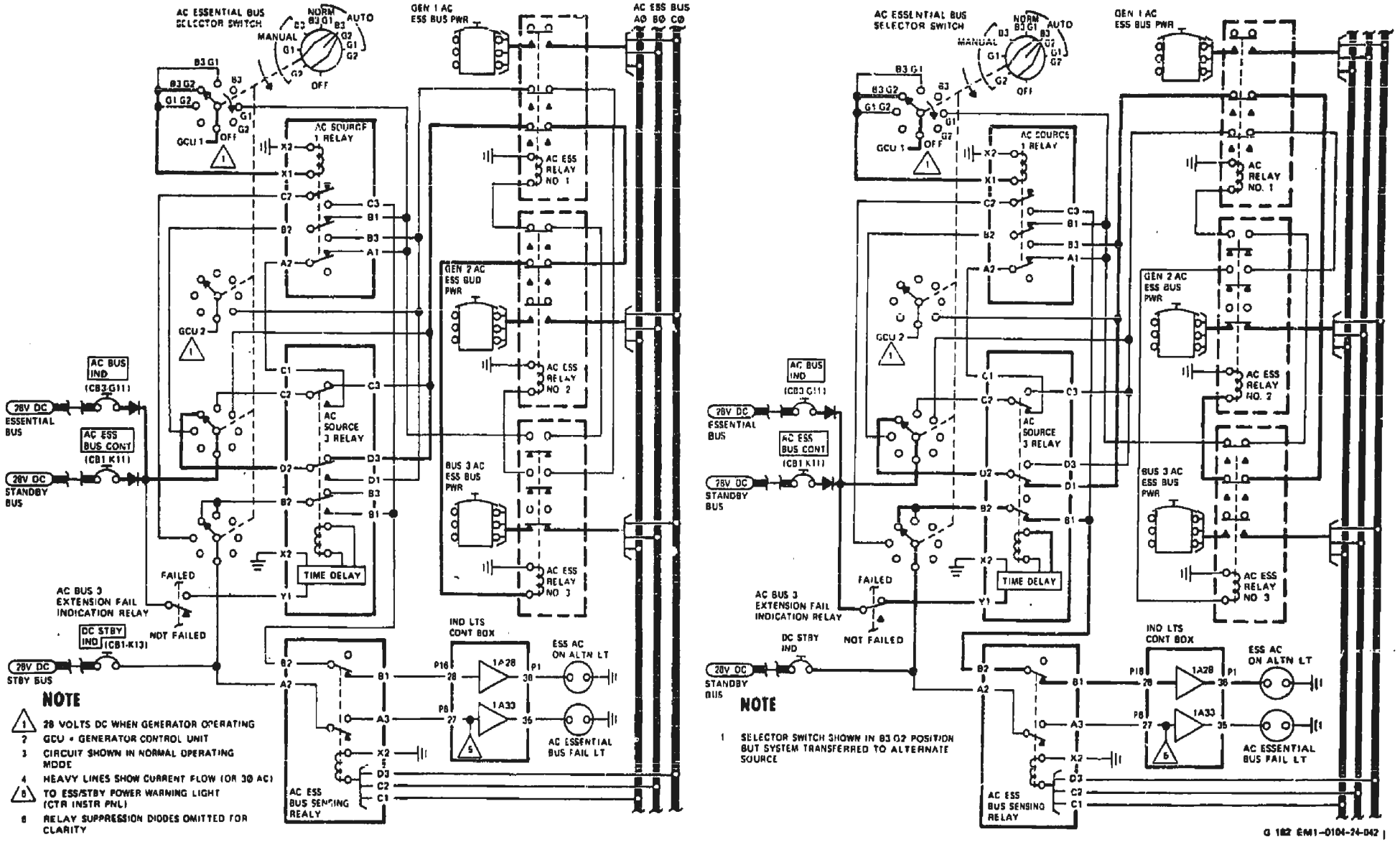
R Flight Engineer/Second Officers Electrical Control Panel
R Figure 2


AC ESSENTIAL BUS SELECTOR SWITCH
NORM B3-G1 AUTO
MANUAL
OFF
GEN 1 AC ESS BUS PWR
AC ESS BUS A0 B0 C0
B3 G1
B3 G2
G1 G2
GCU-1
AC SOURCE 1 RELAY
AC ESS RELAY NO. 1
GEN 2 AC ESS BUS PWR
GCU 2
AC ESS RELAY NO. 2
AC SOURCE 3 RELAY
BUS 3 AC ESS BUS PWR
AC ESS RELAY NO. 3
AS BUS IND (CB3-G11)
28V DC ESSENTIAL BUS
AC ESS BUS CONT (CB1-K11)
28V DC STANDBY BUS
TIME DELAY
FAILED
AC BUS 3 EXTENSION FAIL INDICATION RELAY
NOT FAILED
OC STBY IND (CB1-K13)
28V DC STBY BUS
IND LTS CONT BOX
1A28
1A33
ESS AC ON ALTN LT
AC ESSENTIAL BUS FAIL LT
AC ESS BUS SENSING RELAY
NOTE
1 28 VOLTS DC WHEN GENERATOR OPERATING
2 GCU - GENERATOR CONTROL UNIT
3 CIRCUIT SHOWN IN NORMAL OPERATING MODE
4 HEAVY LINES SHOW CIRCUIT FLOW FOR 3Φ AC
4 TO ESS STBY POWER WARNING LIGHT (CTR INSTR PNL)
5 RELAY SUPPRESSING DIODES OMITTED FOR CLARITY
AC ESSENTIAL BUS SELECTOR SWITCH
NORM B3-G1 AUTO
MANUAL
OFF
GEN 1 AC ESS BUS PWR
B3 G1
B3 G2
G1 G2
GCU-1
AC SOURCE 1 RELAY
AC ESS RELAY NO. 1
GEN 2 AC ESS BUS PWR
GCU 2
AC ESS RELAY NO. 2
AC SOURCE 3 RELAY
BUS 3 AC ESS BUS PWR
AC ESS RELAY NO. 3
AC BUS IND (CB3 G11)
28V DC ESSENTIAL BUS
AC ESS BUS CONT (CB1 K11)
28V DC STANDBY BUS
TIME DELAY
FAILED
NOT FAILED
OC STBY IND
28V DC STANDBY BUS
IND LTS CONT BOX
1A28
1A33
ESS AC ON ALTN LT
AC ESSENTIAL BUS FAIL LT
AC ESS BUS SENSING RELAY
NOTE
1 SELECTOR SWITCH SHOWN IN NORMAL OPERATING MODE BUT SYSTEM TRANSFERRED TO ALTERNATE SOURCE
G 183 EMI 0104-24-041

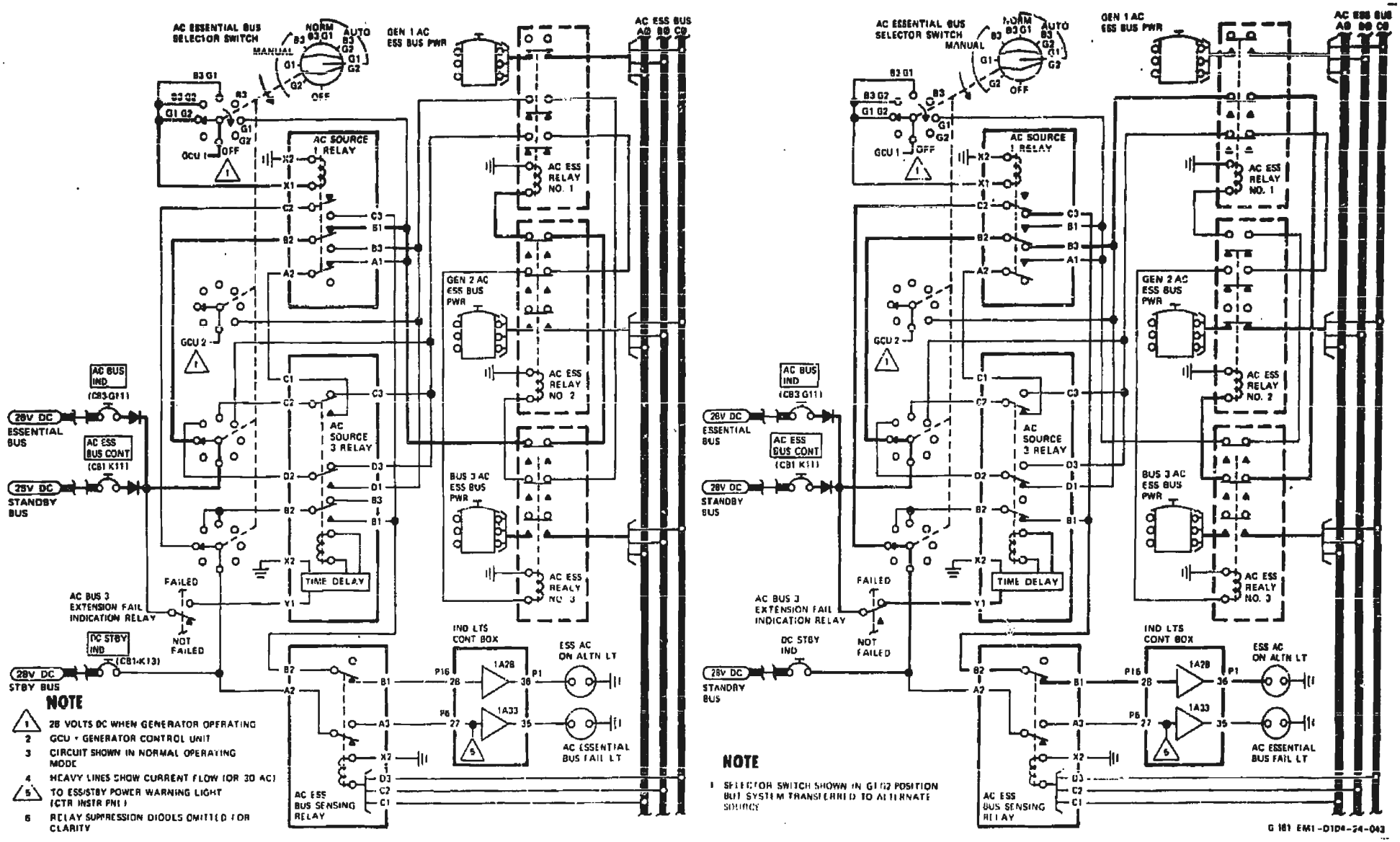
R AC Essential Bus Control System Simplified Schematic B3-(G1) Mode
R Figure 3

EFFECTIVITY: ALL

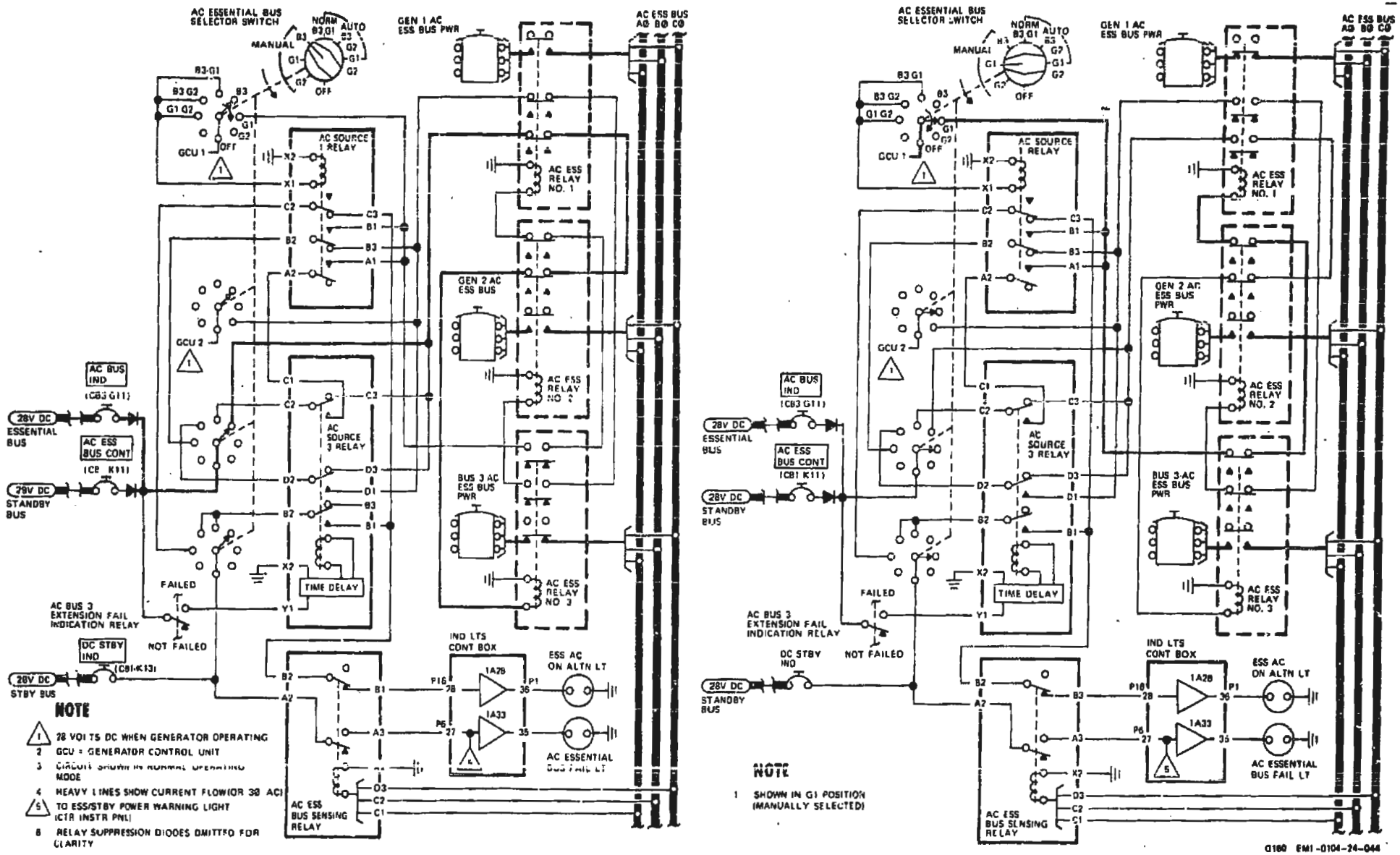
001B


AC ESSENTIAL BUS SELECTOR SWITCH
NORM
AUTO
MANUAL
OFF
GCU 1
GCU 2
AC SOURCE 1 RELAY
AC SOURCE 3 RELAY
TIME DELAY
GEN 1 AC ESS BUS PWR
GEN 2 AC ESS BUS PWR
BUS 3 AC ESS BUS PWR
AC ESS RELAY NO 1
AC ESS RELAY NO 2
AC ESS RELAY NO 3
AC BUS IND (CB3-G11)
AC ESS BUS CONT (CB1-K11)
28V DC ESSENTIAL BUS
28V DC STANDBY BUS
AC BUS 3 EXTENSION FAIL INDICATION RELAY
FAILED
NOT FAILED
DC STBY IND (CB1-K13)
28V DC STBY BUS
IND LTS CONT BOX
ESS AC ON ALTN LT
AC ESSENTIAL BUS FAIL LT
AC ESS BUS SENSING REALY
AC ESS BUS SENSING RELAY
NOTE
1 28 VOLTS DC WHEN GENERATOR OPERATING
2 GCU = GENERATOR CONTROL UNIT
3 CIRCUIT SHOWN IN NORMAL OPERATING MODE
4 HEAVY LINES SHOW CURRENT FLOW (OR 30 AC)
5 TO ESS/STBY POWER WARNING LIGHT (CTR INSTR PNL)
6 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
NOTE
1 SELECTOR SWITCH SHOWN IN B3 G2 POSITION BUT SYSTEM TRANSFERRED TO ALTERNATE SOURCE
G 182 EM1-0104-24-042

R AC Essential Bus Control System Simplified Schematic B3(G2) Mode
R Figure 4


AC ESSENTIAL BUS SELECTOR SWITCH
NORM
AUTO
MANUAL
OFF
GEN 1 AC ESS BUS PWR
AC ESS BUS A0 B0 C0
GCU 1
GCU 2
AC SOURCE 1 RELAY
AC ESS RELAY NO. 1
GEN 2 AC ESS BUS PWR
AC ESS RELAY NO. 2
BUS 3 AC ESS BUS PWR
AC ESS RELAY NO. 3
AC SOURCE 3 RELAY
TIME DELAY
AC BUS IND (CB3-G11)
28V DC ESSENTIAL BUS
AC ESS BUS CONT (CB1-K11)
28V DC STANDBY BUS
AC BUS 3 EXTENSION FAIL INDICATION RELAY
FAILED
NOT FAILED
DC STBY IND (CB1-K13)
28V DC STBY BUS
IND LTS CONT BOX
1A28
1A33
ESS AC ON ALTN LT
AC ESSENTIAL BUS FAIL LT
AC ESS BUS SENSING RELAY
NOTE
1 28 VOLTS DC WHEN GENERATOR OPERATING
2 GCU - GENERATOR CONTROL UNIT
3 CIRCUIT SHOWN IN NORMAL OPERATING MODE
4 HEAVY LINES SHOW CURRENT FLOW (OR 30 AC)
5 TO ESS/STBY POWER WARNING LIGHT (CTR INSTR PNL)
6 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
NOTE
1 SELECTOR SWITCH SHOWN IN G1/G2 POSITION BUT SYSTEM TRANSFERRED TO ALTERNATE SOURCE
G 181 EM1-D104-24-043

R AC Essential Bus Control System Simplified Schematic G1(G2) Mode
R Figure 5


AC ESSENTIAL BUS SELECTOR SWITCH
NORM B3 G1 AUTO
MANUAL
OFF
GEN 1 AC ESS BUS PWR
AC ESS BUS A@ B@ C@
AC SOURCE 1 RELAY
AC ESS RELAY NO. 1
GEN 2 AC ESS BUS
AC ESS RELAY NO. 2
BUS 3 AC ESS BUS PWR
AC ESS RELAY NO. 3
AC SOURCE 3 RELAY
TIME DELAY
GCU 1
GCU 2
AC BUS IND (CB3 G11)
28V DC ESSENTIAL BUS
AC ESS BUS CONT (CB1 K11)
28V DC STANDBY BUS
FAILED
NOT FAILED
AC BUS 3 EXTENSION FAIL INDICATION RELAY
DC STBY IND (CB1-K13)
28V DC STBY BUS
IND LTS CONT BOX
1A28
1A33
ESS AC ON ALTN LT
AC ESSENTIAL BUS FAIL LT
AC ESS BUS SENSING RELAY
NOTE
1 28 VOLTS DC WHEN GENERATOR OPERATING
2 GCU = GENERATOR CONTROL UNIT
3 CIRCUIT SHOWN IN NORMAL OPERATING MODE
4 HEAVY LINES SHOW CURRENT FLOW FOR 3@ ACI
5 TO ESS/STBY POWER WARNING LIGHT (CTR INSTR PNL)
6 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
NOTE
1 SHOWN IN G1 POSITION (MANUALLY SELECTED)
G180 EMI-0104-24-044

R AC Essential Bus Control System Simplified Schematic B3 and G1 Modes
R Figure 6

ESS BUS FAIL light on the Flight Engineers/Second Officers electrical control panel to come on.

Whenever the bus is automatically transferred to an alternate source, the light goes off, and the ESS AC ON ALTN indicator light on the electrical control panel comes on.

B. AC Essential Radio Bus

The three-phase ac essential radio bus (Ref. Fig. 8) is energized from the ac essential bus through three single-phase, push-pull, trip-free circuit breakers (one for each phase). The energizing circuit is through contacts of the energized essential ac master radio relay. The relay is energized with dc essential bus power through the DC ESS BUS - MASTER RADIO CONT circuit breaker on the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215. The energizing circuit continues through contacts of the MASTER RADIO ESSENTIAL switchlight on the pilots master radio (overhead) panel, zone 210. The circuit is completed when the switchlight is depressed (latched in). When the switchlight is released (out) the ac essential radio bus is deenergized and the OFF indication in the switchlight comes on.

C. AC Standby Bus

The single-phase ac standby bus (Ref. Fig. 1) is normally energized from phase A of the ac essential bus through the AC STBY BUS PWR circuit breaker on the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215. The circuit continues through normally closed contacts of the deenergized ac standby transfer relay. In the event of a failed ac essential bus, the inverter is energized. The inverter ac output energizes the two-pole, double-throw ac standby transfer relay. The energized relay transfers the ac standby bus from its normal source to the 115V, 400-Hz, single-phase inverter output (Ref. 24-32-00).

3. AC Essential Relay

A. Description and Operation

The ac essential relay, three of which are used in the ac essential bus control system, is a 50-ampere, triple-pole, single-throw, normally open unit. The relay has, in addition to the main 50-ampere contacts, two sets of single-pole, double-throw auxiliary contacts. The gasket-sealed relay is repairable, has stud terminal connectors, and is located in the flight station overhead circuit breaker panel, zone 215.

The No. 1 relay, when actuated, connects the ac essential bus to the No. 1 generator three-phase output. The No. 2 relay, when actuated, connects the ac essential bus to the No. 2 generator three-phase output. The No. 3 relay, when actuated, connects the ac essential bus to the three-phase ac bus 3. The two sets of auxiliary contacts are used in the control circuitry. The contacts are arranged to prevent any two of the relays from being actuated at the same time.

4. AC Source 1 Relay

A. Description and Operation

The dc-operated ac source 1 relay used in the ac essential bus transfer system is a polarized, 10-ampere, four-pole, double-throw, sealed unit having 14 gold-over-silver plated plug-in-type contacts.

The relay plugs into a prewired socket with holddown flanges on two sides. The normally energized relay works together with the ac source 3 relay to transfer the ac essential bus automatically from a failed power source to an alternate power source.

R 5. 26V ac Navigation Excitation Bus System

A. Description and Operation

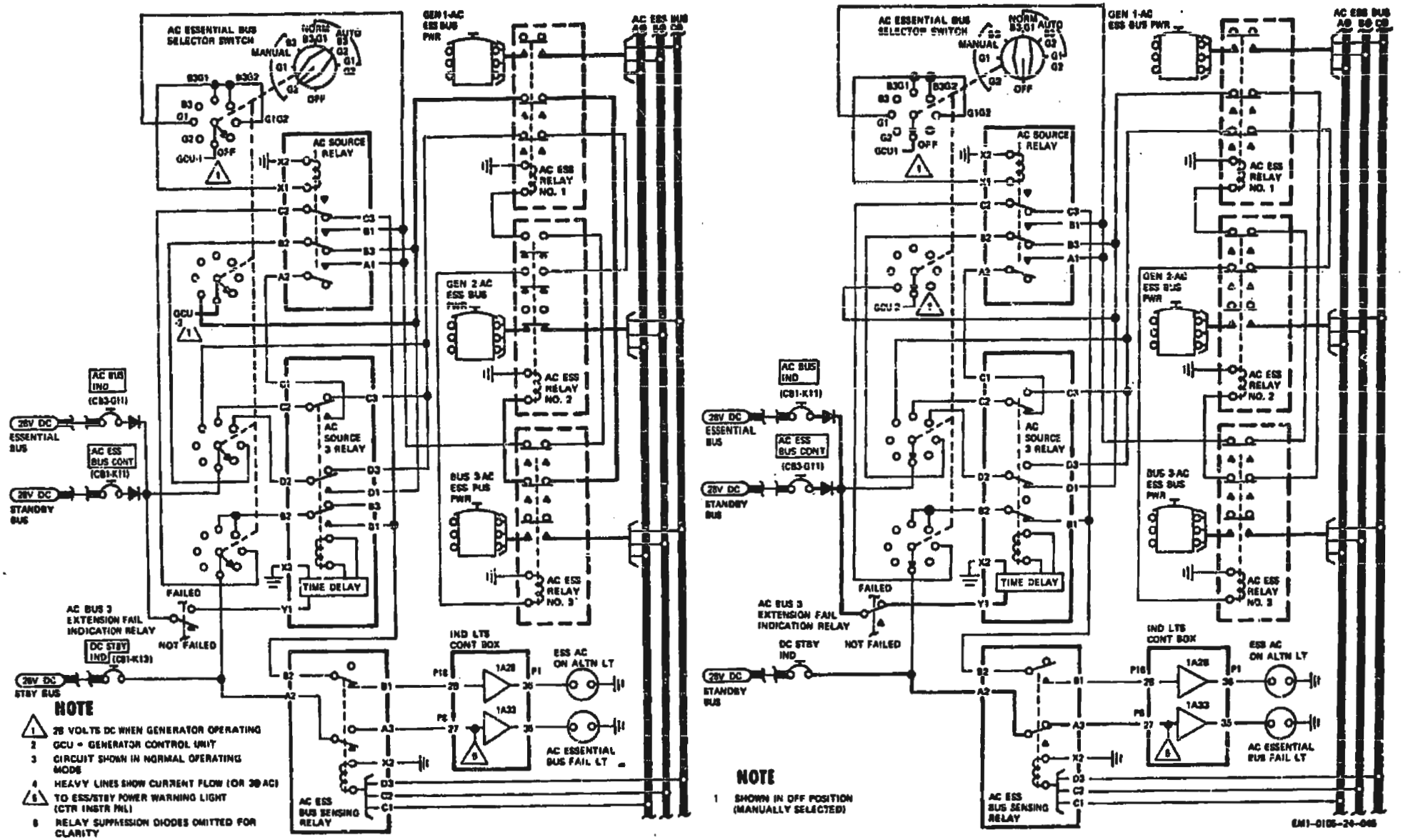
R The three 26V ac navigation excitation buses consist of a
R circuit breaker in the flight station and a stepdown
R transformer for each bus. The transformers are located in
R the forward elctronic service center, zone 112. Each bus
R provides 26V ac, 400-Hz, single-phase power for compass
R couplers and other avionics systems (Ref. Fig. 1)

Transformers No. 1 and 2 are 100-voltampere units that are energized from the ac standby and the ac essential buses, respectively. Transformer No. 3 is a 300-voltampere unit that is energized from the No. 2 ac bus extension.

6. AC Essential Bus Sensing Relay

A. Description and Operation

The ac essential bus sensing relay is used to detect a failed ac essential bus. The relay provides dc signals which cause the AC ESS BUS FAIL (red) and ESS AC ON ALTN (amber) indicator lights on the Flight Engineer/Second Officers electrical control panel, zone 215, to come on



NOTE

1. 28 VOLTS DC WHEN GENERATOR OPERATING
2. GCU = GENERATOR CONTROL UNIT
3. CIRCUIT SHOWN IN NORMAL OPERATING MODE
4. HEAVY LINES SHOW CURRENT FLOW (OR 3Φ AC)
5. TO ESS/STBY POWER WARNING LIGHT (CTR INSTR PNL)
6. RELAY SUPPRESSION DIODES OMITTED FOR CLARITY

NOTE

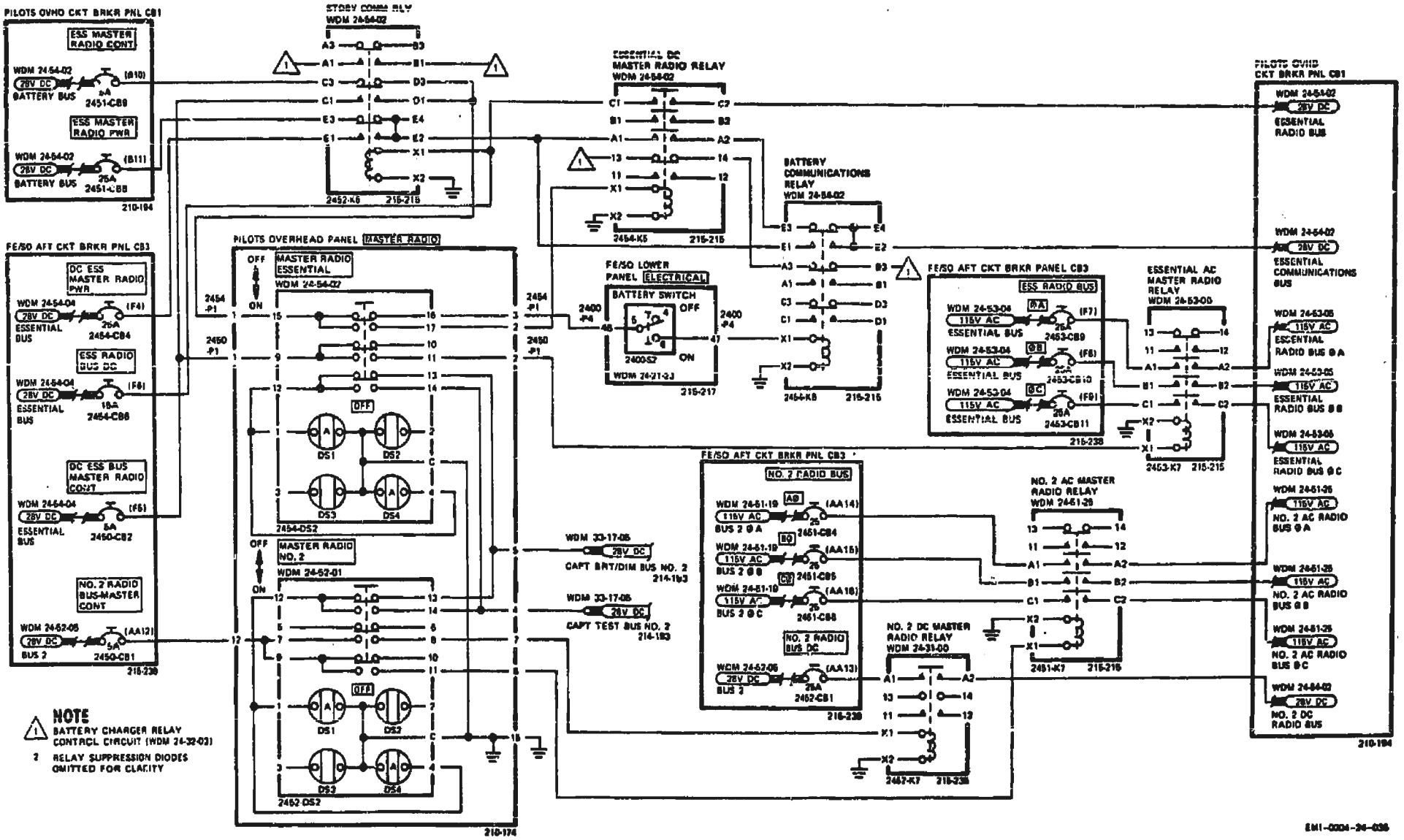
1. SHOWN IN OFF POSITION (MANUALLY SELECTED)

EMI-0105-24-045

R AC Essential Bus Control System Simplified Schematic G2 and OFF
R Modes
R Figure 7

EFFECTIVITY: ALL

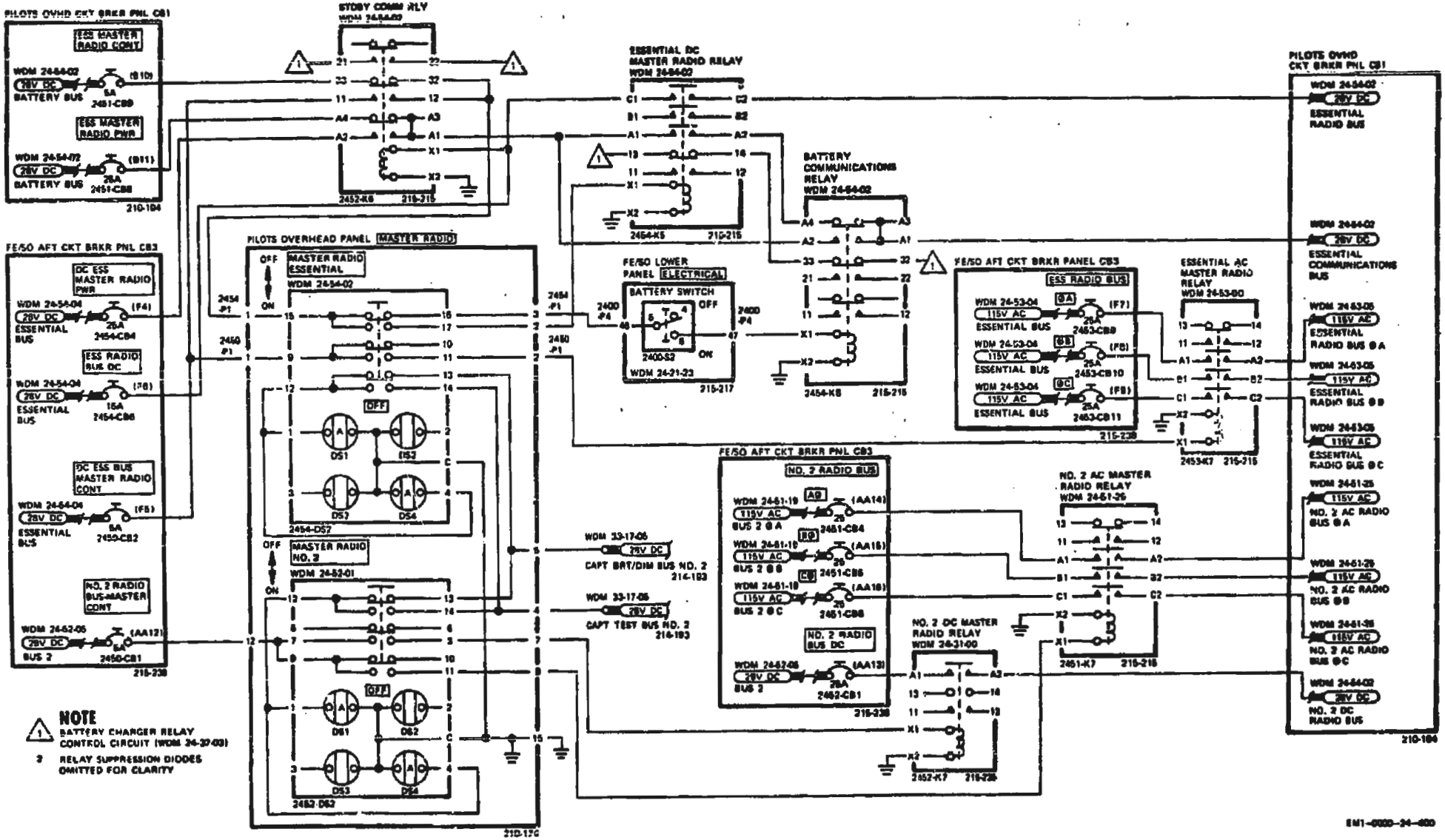
0018



R Radio and Communications Power Distribution System
R Figure 8

EFFECTIVITY: 001-031

UU1B


PILOTS OVHD CKT BRKR PNL CB1
ESS MASTER RADIO CONT
WDM 24-54-02
28V DC BATTERY BUS
5A 2451-CB9
ESS MASTER RADIO PWR
WDM 24-54-02
28V DC BATTERY BUS
25A 2451-CB8
210-104
STDBY COMM RLY
WDM 24-54-02
2452-K6 215-215
ESSENTIAL DC MASTER RADIO RELAY WDM 24-54-02
2454-K5 215-215
BATTERY COMMUNICATIONS RELAY WDM 24-54-02
2454-K8 215-215
FE/SO AFT CKT BRKR PNL CB3
DC ESS MASTER RADIO PWR
WDM 24-54-04
28V DC ESSENTIAL BUS
25A 2454-CB4
ESS RADIO BUS DC
WDM 24-54-04
28V DC ESSENTIAL BUS
15A 2454-CB6
DC ESS BUS MASTER RADIO CONT
WDM 24-54-04
28V DC ESSENTIAL BUS
5A 2450-CB2
NO. 2 RADIO BUS-MASTER CONT
WDM 24-52-05
28V DC BUS 2
5A 2450-CB1
215-238
PILOTS OVERHEAD PANEL MASTER RADIO
MASTER RADIO ESSENTIAL
WDM 24-54-02
2454-DS7
MASTER RADIO NO. 2
WDM 24-52-01
2452-DS7
210-170
FE/SO LOWER PANEL ELECTRICAL
BATTERY SWITCH
2400-S2
WDM 24-21-23
215-217
FE/SO AFT CKT BRKR PANEL CB3
ESS RADIO BUS
WDM 24-53-04 115V AC ESSENTIAL BUS 25A 2453-CB9
WDM 24-53-04 115V AC ESSENTIAL BUS 25A 2453-CB10
WDM 24-53-04 115V AC ESSENTIAL BUS 25A 2453-CB11
215-238
ESSENTIAL AC MASTER RADIO RELAY WDM 24-53-00
2453-K7 215-215
FE/SO AFT CKT BRKR PNL CB3
NO. 2 RADIO BUS
WDM 24-61-19 115V AC BUS 2 ⊕A 25A 2451-CB4 (AA14)
WDM 24-61-19 115V AC BUS 2 ⊕B 25A 2451-CB5 (AA15)
WDM 24-61-19 115V AC BUS 2 ⊕C 25A 2451-CB6 (AA16)
NO. 2 RADIO BUS DC
WDM 24-52-05 28V DC BUS 2 25A 2452-CB1 (AA13)
215-238
NO. 2 AC MASTER RADIO RELAY WDM 24-61-26
2451-K7 215-215
NO. 2 DC MASTER RADIO RELAY WDM 24-31-00
2452-K7 215-215
WDM 33-17-06 28V DC CAPT BRT/DIM BUS NO. 2 214-103
WDM 33-17-06 28V DC CAPT TEST BUS NO. 2 214-103
PILOTS OVHD CKT BRKR PNL CB1
WDM 24-54-02 28V DC ESSENTIAL RADIO BUS
WDM 24-54-02 28V DC ESSENTIAL COMMUNICATIONS BUS
WDM 24-53-05 115V AC ESSENTIAL RADIO BUS ⊕A
WDM 24-53-05 115V AC ESSENTIAL RADIO BUS ⊕B
WDM 24-53-05 115V AC ESSENTIAL RADIO BUS ⊕C
WDM 24-61-25 115V AC NO. 2 AC RADIO BUS ⊕A
WDM 24-61-25 115V AC NO. 2 AC RADIO BUS ⊕B
WDM 24-61-25 115V AC NO. 2 AC RADIO BUS ⊕C
WDM 24-54-02 28V DC NO. 2 DC RADIO BUS
210-104
NOTE
1 BATTERY CHARGER RELAY CONTROL CIRCUIT (WDM 24-27-03)
2 RELAY SUPPRESSION DIODES OMITTED FOR CLARITY
EM1-0000-24-000

R Radio and Communications Power Distribution System
R Figure 8

under certain conditions. The ac-operated, normally energized relay is a 2-ampere, double-pole, double-throw, undervoltage-sensing, three-phase, continuous-duty unit. The relay senses the voltage on the three-phase ac essential bus and deenergizes when that voltage decreases to a certain value. The relay plugs into a prewired socket with holddown flanges on each side in the Flight Engineer/Second Officers console area, zone 215. Contact pins on the relay are gold-over-silver plated.

In normal operation, when the ac essential bus sensing relay senses a potential of 104(±2) volts on each of the three phases of the ac essential bus, the relay is energized. Whenever the average voltage of the three phases decreases to 95(±2) volts, the relay deenergizes and causes the AC ESS BUS FAIL indicator light to come on momentarily. At the same time, the ESS/STBY POWER (red) warning light on the pilots center instrument panel, zone 210, comes on. After a 2-second time delay (up to 6 seconds in the G1 (G2) position), the transfer system operates and reenergizes the bus from an alternate source. The AC ESS BUS FAIL indicator light and the ESS/STBY POWER warning light go off and a second set of contacts causes the ESS AC ON ALTN indicator light to come on.

7. AC Source 3 Relay

A. Description and Operation

The ac source 3 relay is a 10 ampere four-pole, double-throw, sealed unit. The time-delay relay plugs into a prewired socket in the Flight Engineer/Second Officers console area, zone 215. The normally deenergized relay works together with the ac source 1 relay to transfer the ac essential bus automatically from a failed power source to an alternate power source.

R # AC ESSENTIAL AND STANDBY BUS SYSTEM - FAULT ISOLATION

R 1. General

R The diagrams and schematics in this section can be used for fault isolation any time a fault is reported or suspected. The PREREQUISITES listed at the top of each fault isolation diagram must be satisfied prior to starting fault isolation. Uncommon abbreviations are defined on the using fault code diagram or schematic.

R If the flight crew reports a trouble using a fault code number, the code can be found in the Fault Isolation Reference Table in the chapter 24 Fault Code Index. The index specifies the exact maintenance manual section, fault isolation diagram, and block number on the diagram where the fault isolation procedure should start. Schematics are included at the end of the section to supplement the fault code diagrams or as an aid in isolating a problem not covered on the diagrams.

R Refer to the Maintenance Manual Introduction for a more detailed discussion of the Fault Isolation Reporting Method (FIRM) and use of fault isolation diagrams/schematic.

R 2. Fault Isolation/Identification

R Table 101 lists the fault isolation diagrams and schematics in this section.

R AC Essential and Standby Bus System Fault Isolation Diagrams
Table 101

FIGURE	TITLE
Fig. 101	Component Locator Index
Fig. 102	Component Locator Diagram
Fig. 103	AC Essential Bus Selector NORM Fault Isolation
Fig. 104	AC Essential Bus Selector B3(G2) Fault Isolation
Fig. 105	AC Essential Bus Selector G1(G2) Fault Isolation
SCHEM 1	AC Essential Bus Schematic
SCHEM 2	Essential AC Radio Bus Schematic

R AC Essential and Standby Bus System Fault Isolation Diagrams (Cont)
R Table 101

FIGURE	TITLE
SCHEM 3	AC Standby Bus Schematic

COMPONENT	QTY	AREA/ACCESS	REFERENCE
CIRCUIT BREAKERS			
GEN 1 AC ESS BUS PWR RCCB-CB1	1	MESC, AC DISTRIBUTION BOX/ ZONE 137	24-53-01
GEN 2 AC ESS BUS PWR RCCB-CB2	1	MESC, AC DISTRIBUTION BOX/ ZONE 137	24-53-02
GEN 3 AC ESS BUS PWR RCCB-CB3	1	MESC, REMOTE CONTROL CIRCUIT BREAKER BOX/ZONE 137	24-53-01
CONTROL BOX - INDICATOR LIGHT	1	FESC/112AB, 211CB	33-17-04
LAMPS -SWITCHLIGHT	2	FE/SO ELECTRICAL CONTROL PANEL	20-33-01
RELAYS			
AC ESS RELAY NO. 1 (2453-K1)	1	FLT STA/BEHIND CB-2 P9, P10	24-53-02
AC ESS RELAY NO. 2 (2453-K2)	1	FLT STA/BEHIND CB-2 P9, P10	24-53-02
AC ESS RELAY NO. 3 (2453-K3)	1	FLT STA/BEHIND CB-2 P9, P10	24-53-02
AC ESS BUS SENSING RELAY (2453-K4)	1	FLT STA/BEHIND FE/SO KICK PANEL	24-53-01
AC SOURCE 1 RELAY (2453-K5)	1	FLT STA/BEHIND FE/SO KICK PANEL	24-53-02
AC SOURCE 3 RELAY (2453-K6)	1	FLT STA/BEHIND FE/SO KICK PANEL	24-53-02

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Component Locator Index
Figure 101

EFFECTIVITY: ALL

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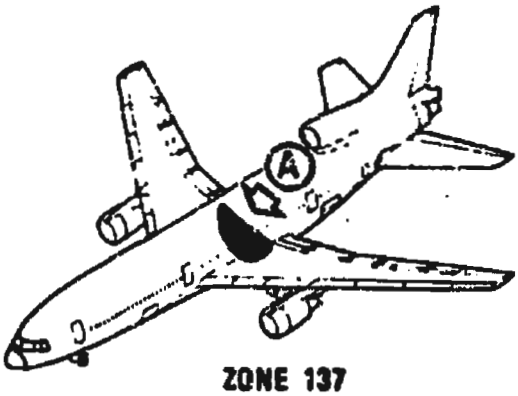
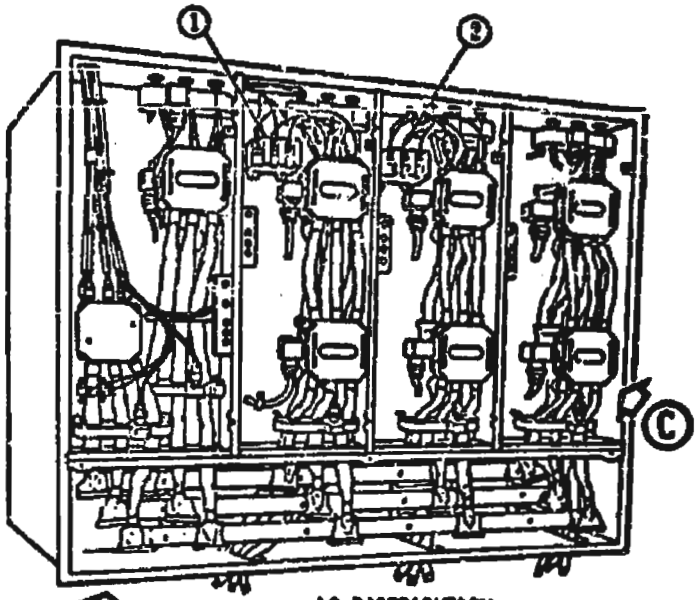
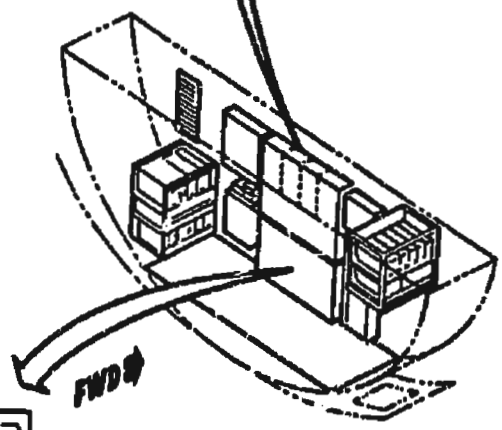


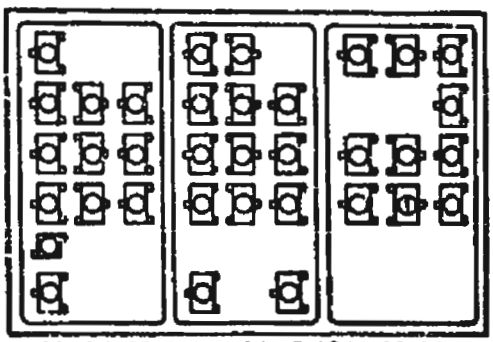
ZONE 137



AC DISTRIBUTION
1. NO. 1 GENERATOR - AC ESSENTIAL BUS PWR RCCB
2. NO. 2 GENERATOR - AC ESSENTIAL BUS PWR RCCB



MID ELECTRICAL SERVICE CENTER



REMOTE CONTROL CIRCUIT BREAKER BOX
1. GEN 3 AC ESS BUS PWR RCCB-CB3

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R
R

Component Locator Diagram
Figure 102 (Sheet 1)

EFFECTIVITY: ALL

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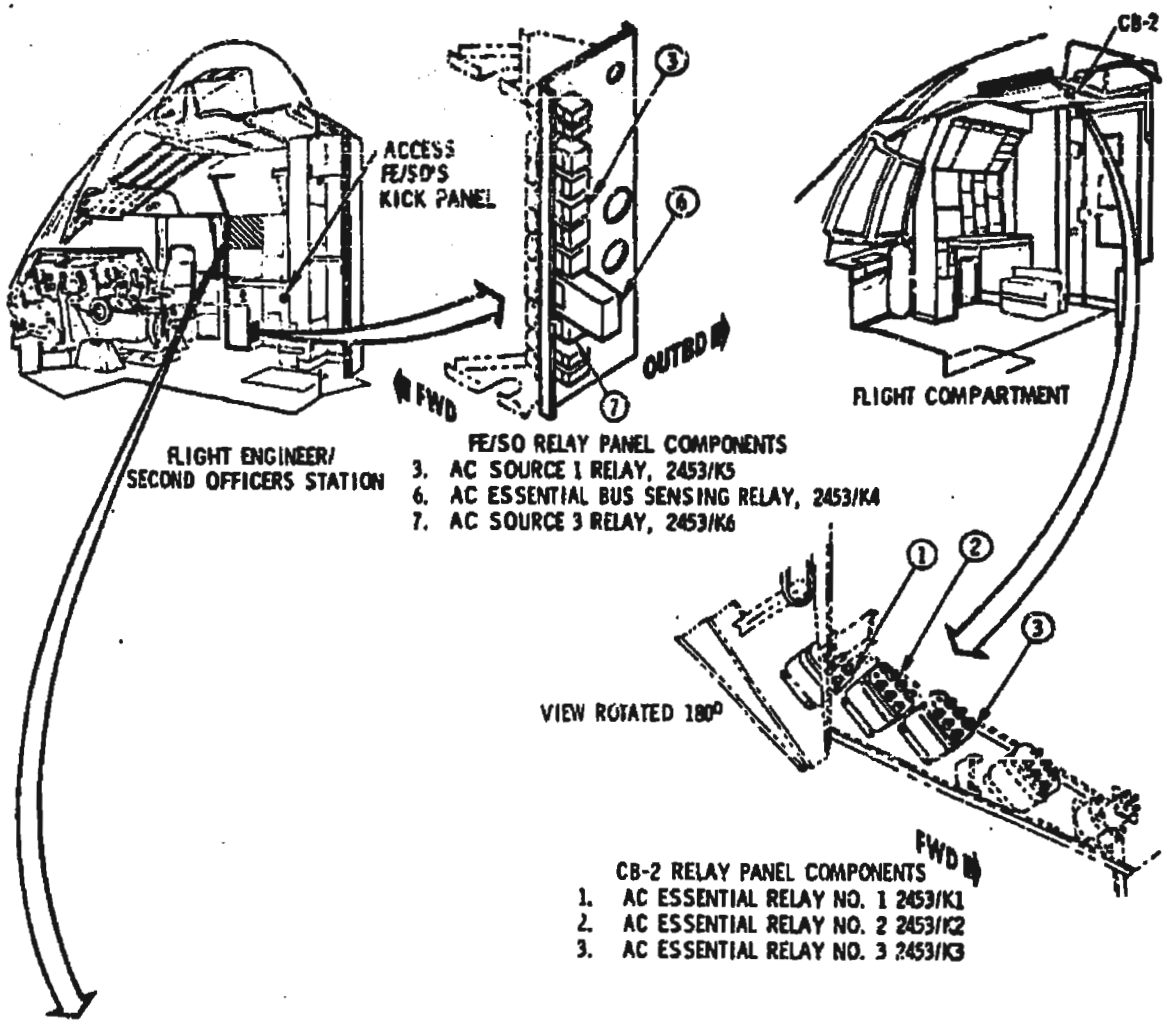
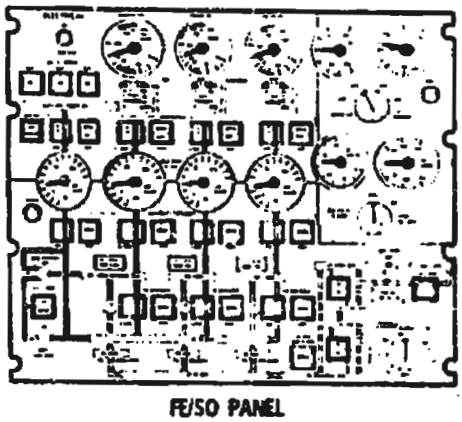
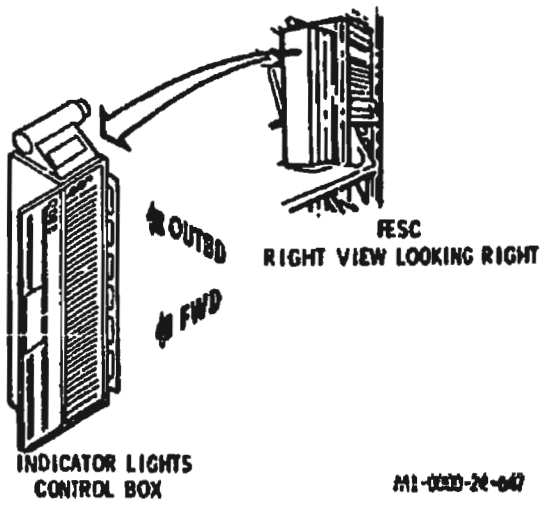



FE/SO PANEL



FESC
RIGHT VIEW LOOKING RIGHT

INDICATOR LIGHTS
CONTROL BOX

M1-0000-24-047

R
R Component Locator Diagram
Figure 102 (Sheet 2)

R EFFECTIVITY: ALL
R
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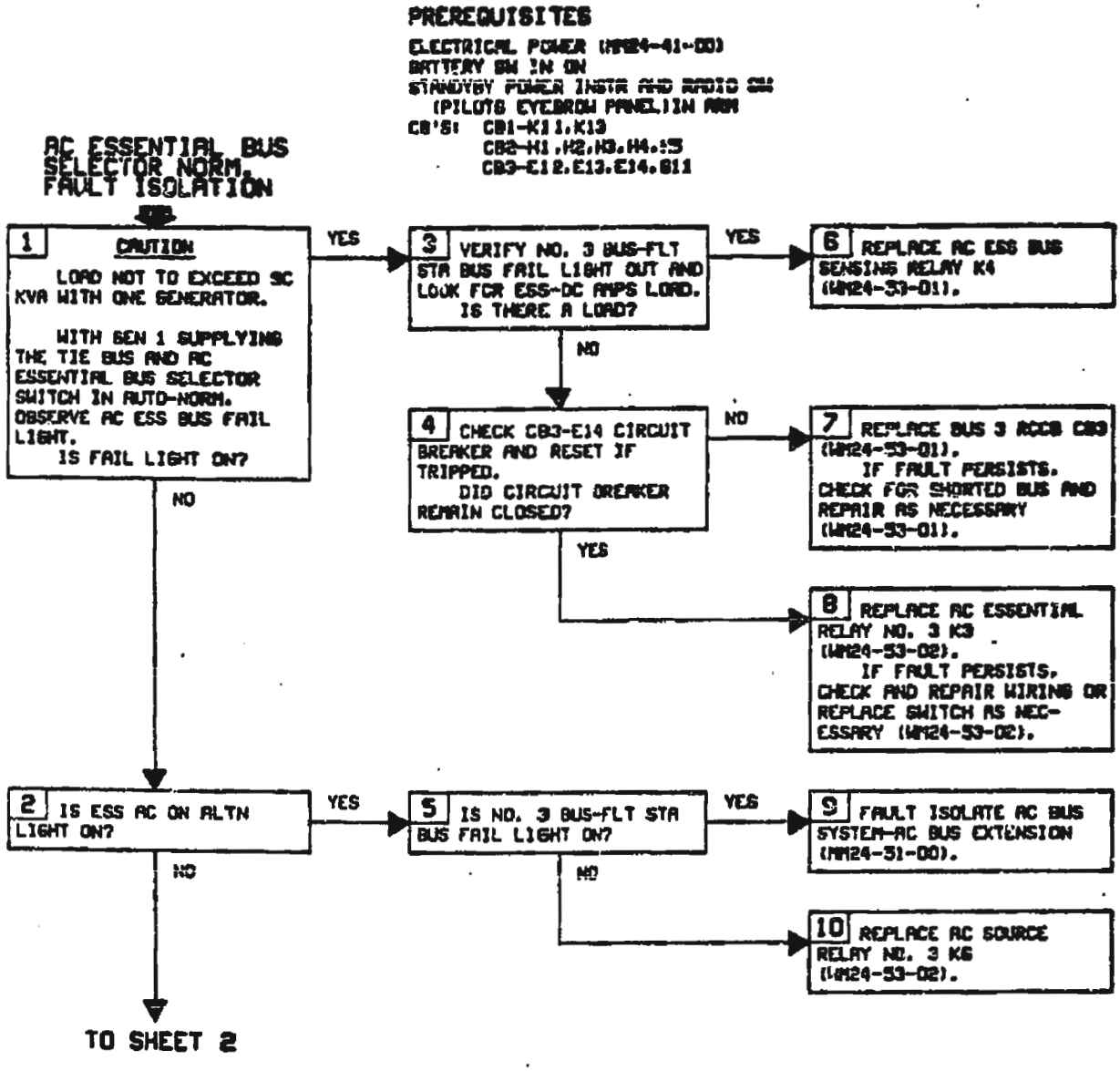
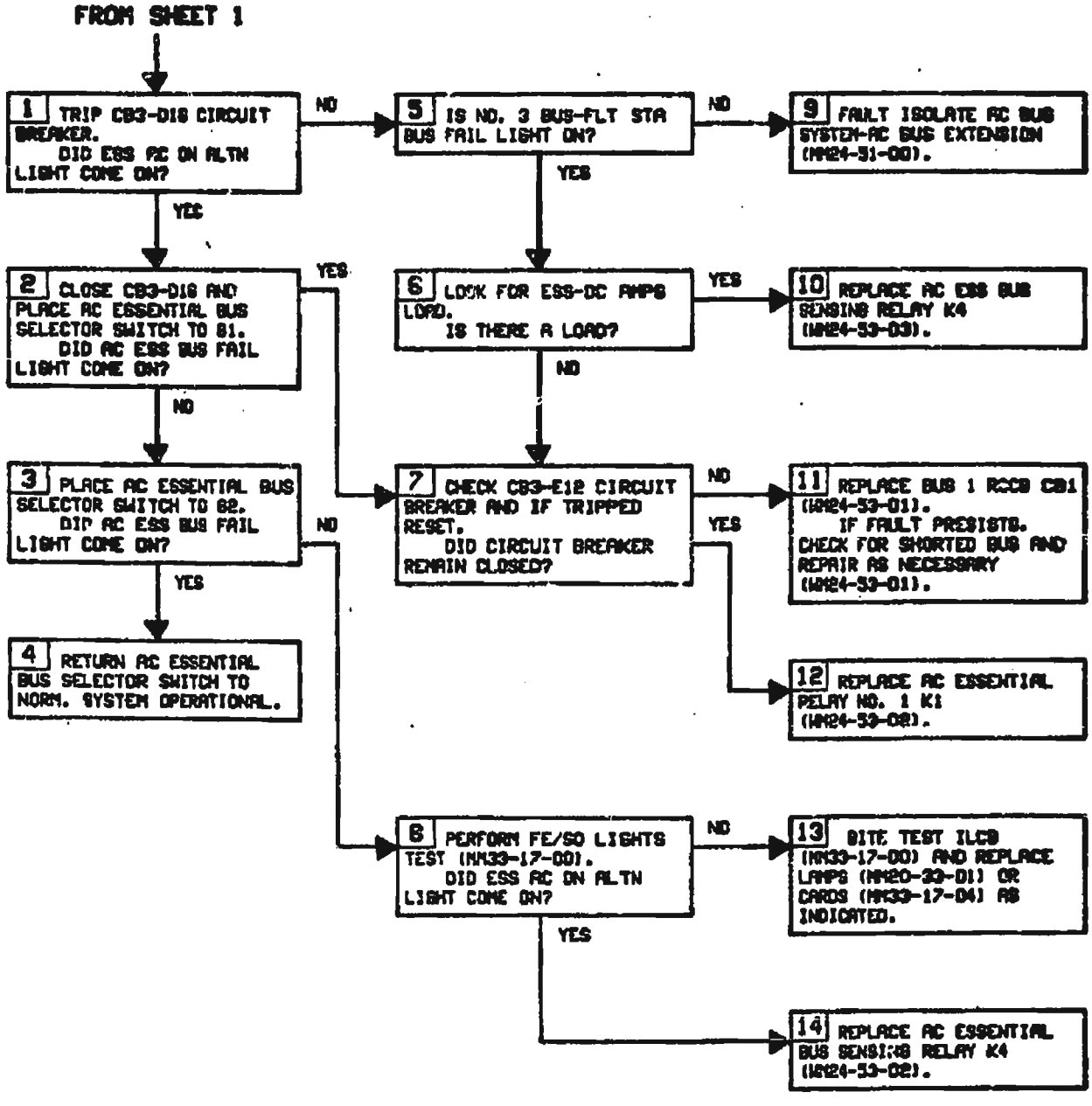

PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
BATTERY SW IN ON
STANDBY POWER INSTR AND RADIO SW
(PILOTS EYEBROW PANEL) IN ARM
CB'S: CB1-K11,K13
CB2-H1,H2,H3,H4,H5
CB3-E12,E13,E14,B11
AC ESSENTIAL BUS SELECTOR NORM, FAULT ISOLATION
1 CAUTION
LOAD NOT TO EXCEED 90 KVA WITH ONE GENERATOR.
WITH GEN 1 SUPPLYING THE TIE BUS AND AC ESSENTIAL BUS SELECTOR SWITCH IN AUTO-NORM, OBSERVE AC ESS BUS FAIL LIGHT.
IS FAIL LIGHT ON?
YES
NO
2 IS ESS AC ON ALTN LIGHT ON?
YES
NO
3 VERIFY NO. 3 BUS-FLT STR BUS FAIL LIGHT OUT AND LOOK FOR ESS-DC AMPS LOAD.
IS THERE A LOAD?
YES
NO
4 CHECK CB3-E14 CIRCUIT BREAKER AND RESET IF TRIPPED.
DID CIRCUIT BREAKER REMAIN CLOSED?
NO
YES
5 IS NO. 3 BUS-FLT STR BUS FAIL LIGHT ON?
YES
NO
6 REPLACE AC ESS BUS SENSING RELAY K4 (MM24-33-01).
7 REPLACE BUS 3 ACCB CB3 (MM24-53-01).
IF FAULT PERSISTS, CHECK FOR SHORTED BUS AND REPAIR AS NECESSARY (MM24-53-01).
8 REPLACE AC ESSENTIAL RELAY NO. 3 K3 (MM24-53-02).
IF FAULT PERSISTS, CHECK AND REPAIR WIRING OR REPLACE SWITCH AS NECESSARY (MM24-53-02).
9 FAULT ISOLATE AC BUS SYSTEM-AC BUS EXTENSION (MM24-51-00).
10 REPLACE AC SOURCE RELAY NO. 3 K6 (MM24-53-02).
TO SHEET 2

M1-0003-24-571

R AC Essential Bus Selector NORM Fault Isolation
R Figure 103 (Sheet 1)

PREREQUISITES
SEE SHEET 1


FROM SHEET 1
1 TRIP CB3-D18 CIRCUIT BREAKER. DID ESS AC ON ALTN LIGHT COME ON?
NO
YES
5 IS NO. 3 BUS-FLT STA BUS FAIL LIGHT ON?
NO
YES
9 FAULT ISOLATE AC BUS SYSTEM-AC BUS EXTENSION (MM24-51-00).
2 CLOSE CB3-D18 AND PLACE AC ESSENTIAL BUS SELECTOR SWITCH TO B1. DID AC ESS BUS FAIL LIGHT COME ON?
YES
NO
6 LOOK FOR ESS-DC AMPS LOAD. IS THERE A LOAD?
YES
NO
10 REPLACE AC ESS BUS SENSING RELAY K4 (MM24-53-03).
3 PLACE AC ESSENTIAL BUS SELECTOR SWITCH TO B2. DID AC ESS BUS FAIL LIGHT COME ON?
NO
YES
7 CHECK CB3-E12 CIRCUIT BREAKER AND IF TRIPPED RESET. DID CIRCUIT BREAKER REMAIN CLOSED?
NO
YES
11 REPLACE BUS 1 RCCB CB1 (MM24-53-01). IF FAULT PRESISTS. CHECK FOR SHORTED BUS AND REPAIR AS NECESSARY (MM24-53-01).
12 REPLACE AC ESSENTIAL RELAY NO. 1 K1 (MM24-53-02).
4 RETURN AC ESSENTIAL BUS SELECTOR SWITCH TO NORM. SYSTEM OPERATIONAL.
8 PERFORM FE/SO LIGHTS TEST (MM33-17-00). DID ESS AC ON ALTN LIGHT COME ON?
NO
YES
13 BITE TEST ILCB (MM33-17-00) AND REPLACE LAMPS (MM20-33-01) OR CARDS (MM33-17-04) AS INDICATED.
14 REPLACE AC ESSENTIAL BUS SENSING RELAY K4 (MM24-53-02).

R1-0000-24-0000

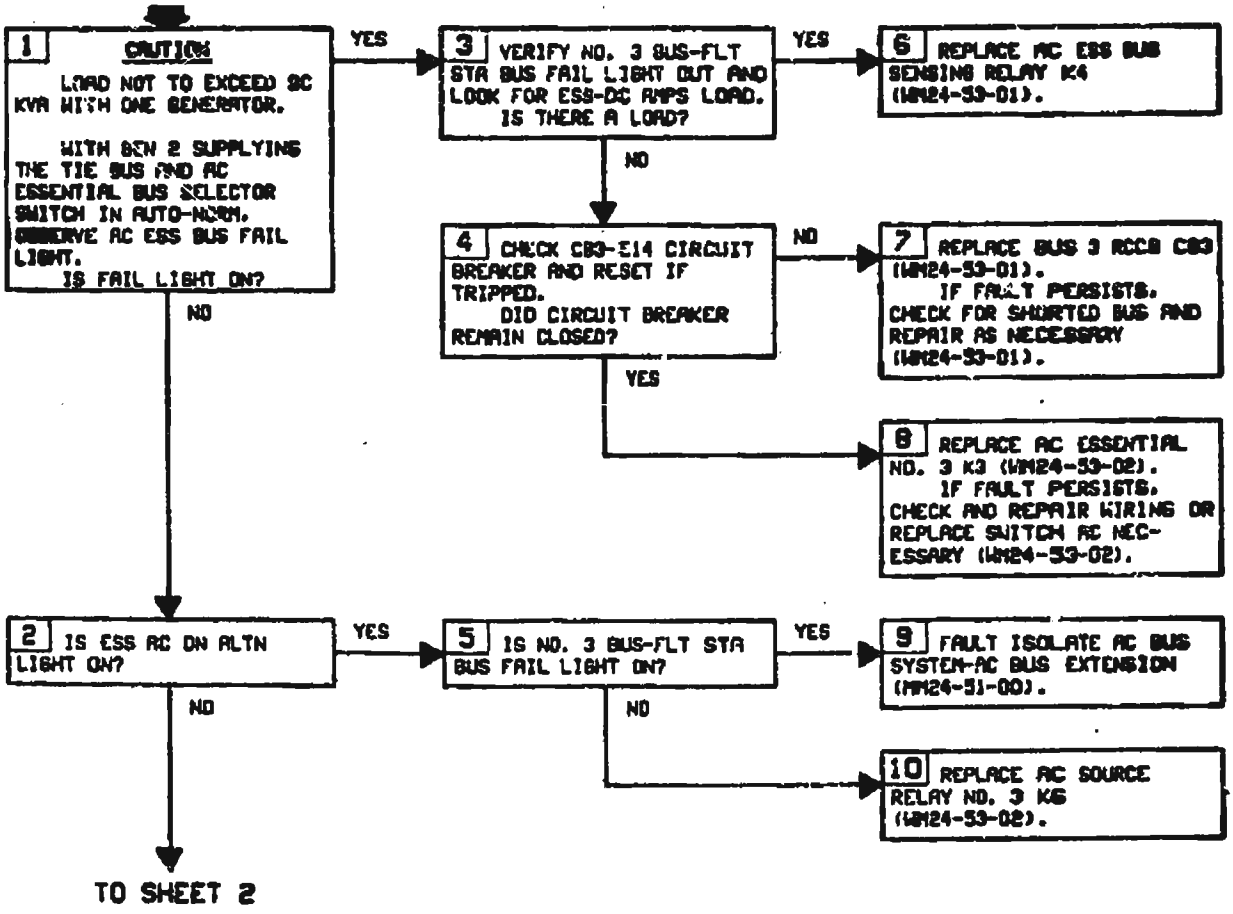
R AC Essential Bus Selector NORM Fault Isolation
R Figure 103 (Sheet 2)

EFFECTIVITY: ALL

PREREQUISITES

ELECTRICAL POWER (MM24-41-00)
BATTERY SW IN ON
STANDBY POWER INSTR AND RADIO SW
(PILOTS EYEBROW PANEL) IN ARM
CB'S: CB1-K11,K19
CB2-K1,K2,K3,K4,K5
CB3-C12,C13,C14,B11

AC ESSENTIAL BUS SELECTOR B3/G2 FAULT ISOLATION


1 CAUTION
LOAD NOT TO EXCEED 90 KVA WITH ONE GENERATOR.
WITH GEN 2 SUPPLYING THE TIE BUS AND AC ESSENTIAL BUS SELECTOR SWITCH IN AUTO-NORM. OBSERVE AC ESS BUS FAIL LIGHT.
IS FAIL LIGHT ON?
YES
NO
2 IS ESS AC ON ALTN LIGHT ON?
YES
NO
3 VERIFY NO. 3 BUS-FLT STR BUS FAIL LIGHT OUT AND LOOK FOR ESS-DC AMPS LOAD.
IS THERE A LOAD?
YES
NO
4 CHECK CB3-E14 CIRCUIT BREAKER AND RESET IF TRIPPED.
DID CIRCUIT BREAKER REMAIN CLOSED?
NO
YES
5 IS NO. 3 BUS-FLT STR BUS FAIL LIGHT ON?
YES
NO
6 REPLACE AC ESS BUS SENSING RELAY K4 (MM24-53-01).
7 REPLACE BUS 3 RCCB CB3 (MM24-53-01).
IF FAULT PERSISTS. CHECK FOR SHUNTED BUS AND REPAIR AS NECESSARY (MM24-53-01).
8 REPLACE AC ESSENTIAL NO. 3 K3 (MM24-53-02).
IF FAULT PERSISTS. CHECK AND REPAIR WIRING OR REPLACE SWITCH AS NECESSARY (MM24-53-02).
9 FAULT ISOLATE AC BUS SYSTEM-AC BUS EXTENSION (MM24-51-00).
10 REPLACE AC SOURCE RELAY NO. 3 K6 (MM24-53-02).
TO SHEET 2

M1-0004-24-572

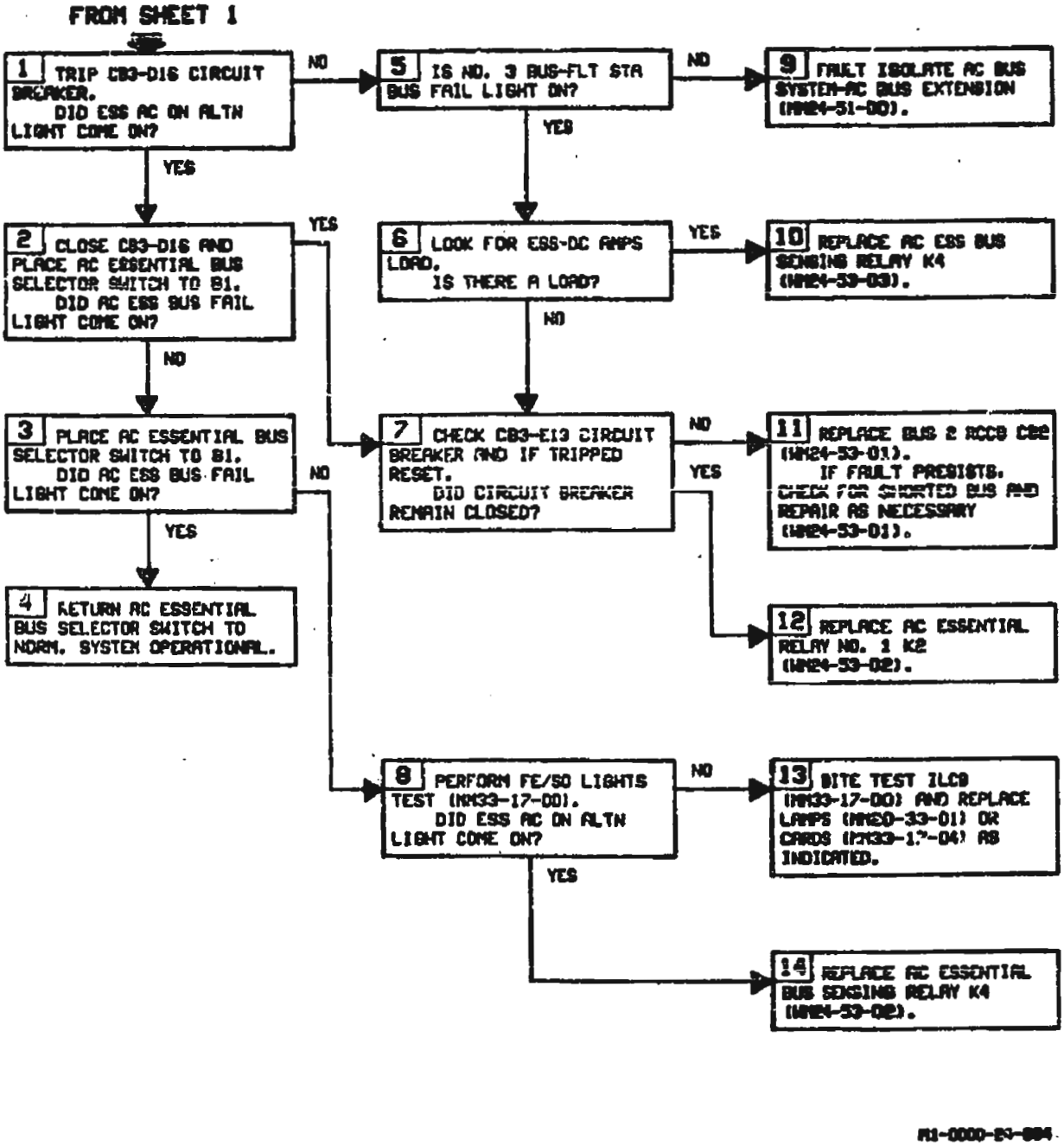
R AC Essential Bus Selector B3(G2) Fault Isolation
R Figure 104 (Sheet 1)

EFFECTIVITY: ALL

001B

PREREQUISITES

SEE SHEET 1


FROM SHEET 1
1 TRIP CB3-D16 CIRCUIT BREAKER. DID ESS AC ON ALTN LIGHT COME ON?
NO
YES
5 IS NO. 3 BUS-FLT STA BUS FAIL LIGHT ON?
NO
YES
9 FAULT ISOLATE AC BUS SYSTEM-AC BUS EXTENSION (WM24-51-00).
2 CLOSE CB3-D16 AND PLACE AC ESSENTIAL BUS SELECTOR SWITCH TO B1. DID AC ESS BUS FAIL LIGHT COME ON?
YES
NO
6 LOOK FOR ESS-DC AMPS LOAD. IS THERE A LOAD?
YES
NO
10 REPLACE AC ESS BUS SENSING RELAY K4 (WM24-53-03).
3 PLACE AC ESSENTIAL BUS SELECTOR SWITCH TO B1. DID AC ESS BUS FAIL LIGHT COME ON?
NO
YES
7 CHECK CB3-E13 CIRCUIT BREAKER AND IF TRIPPED RESET. DID CIRCUIT BREAKER REMAIN CLOSED?
NO
YES
11 REPLACE BUS 2 RCCB CBE (WM24-53-01). IF FAULT PERSISTS. CHECK FOR SHORTED BUS AND REPAIR AS NECESSARY (WM24-53-01).
12 REPLACE AC ESSENTIAL RELAY NO. 1 K2 (WM24-53-02).
4 RETURN AC ESSENTIAL BUS SELECTOR SWITCH TO NORM. SYSTEM OPERATIONAL.
8 PERFORM FE/SO LIGHTS TEST (WM33-17-00). DID ESS AC ON ALTN LIGHT COME ON?
NO
YES
13 BITE TEST ILCB (WM33-17-00) AND REPLACE LAMPS (WM80-33-01) OR CARDS (PM33-17-04) AS INDICATED.
14 REPLACE AC ESSENTIAL BUS SENSING RELAY K4 (WM24-53-02).

R1-0000-24-004

R AC Essential Bus Selector B3(G2) Fault Isolation
R Figure 104 (Sheet 2)

R EFFECTIVITY: ALL

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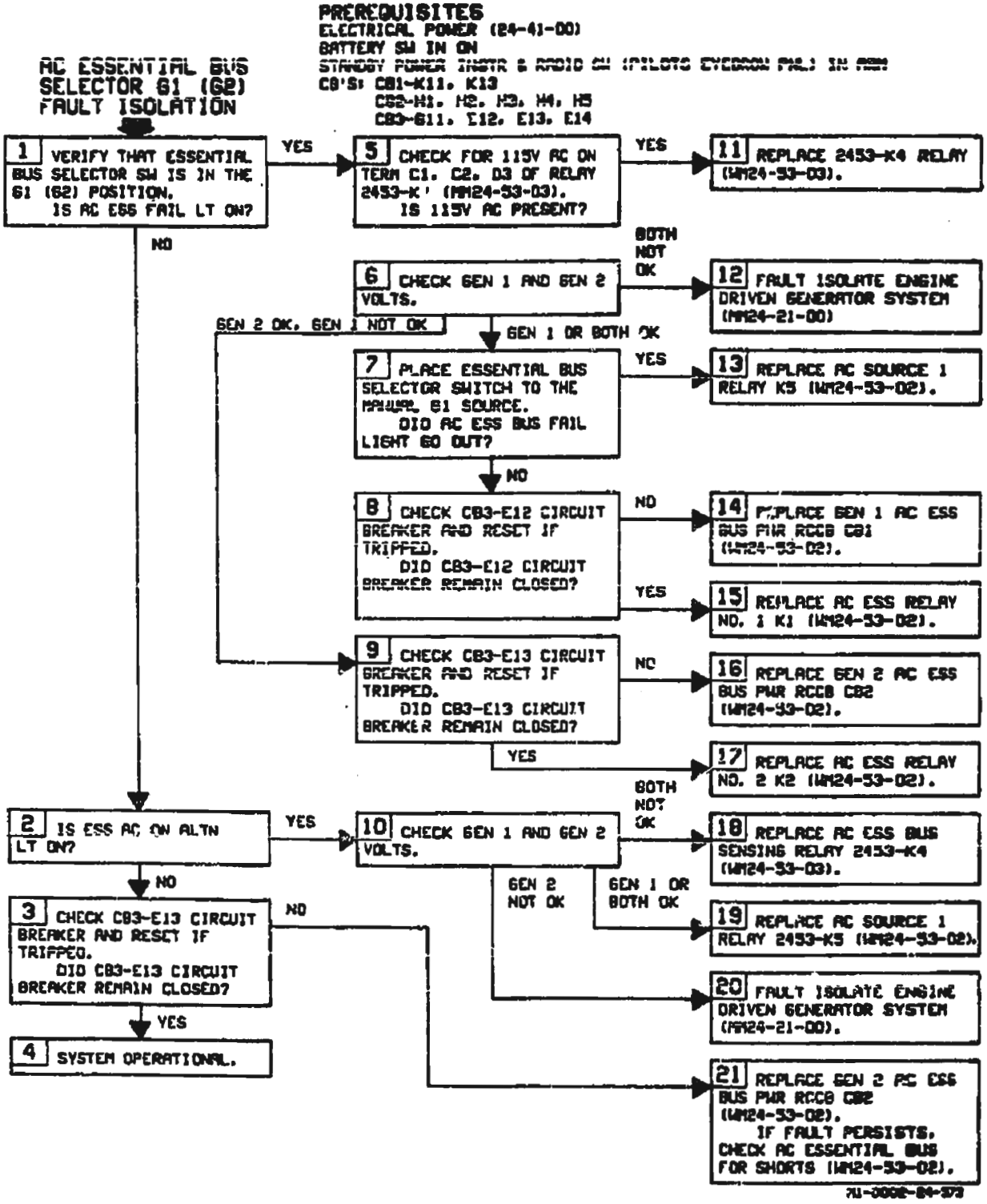
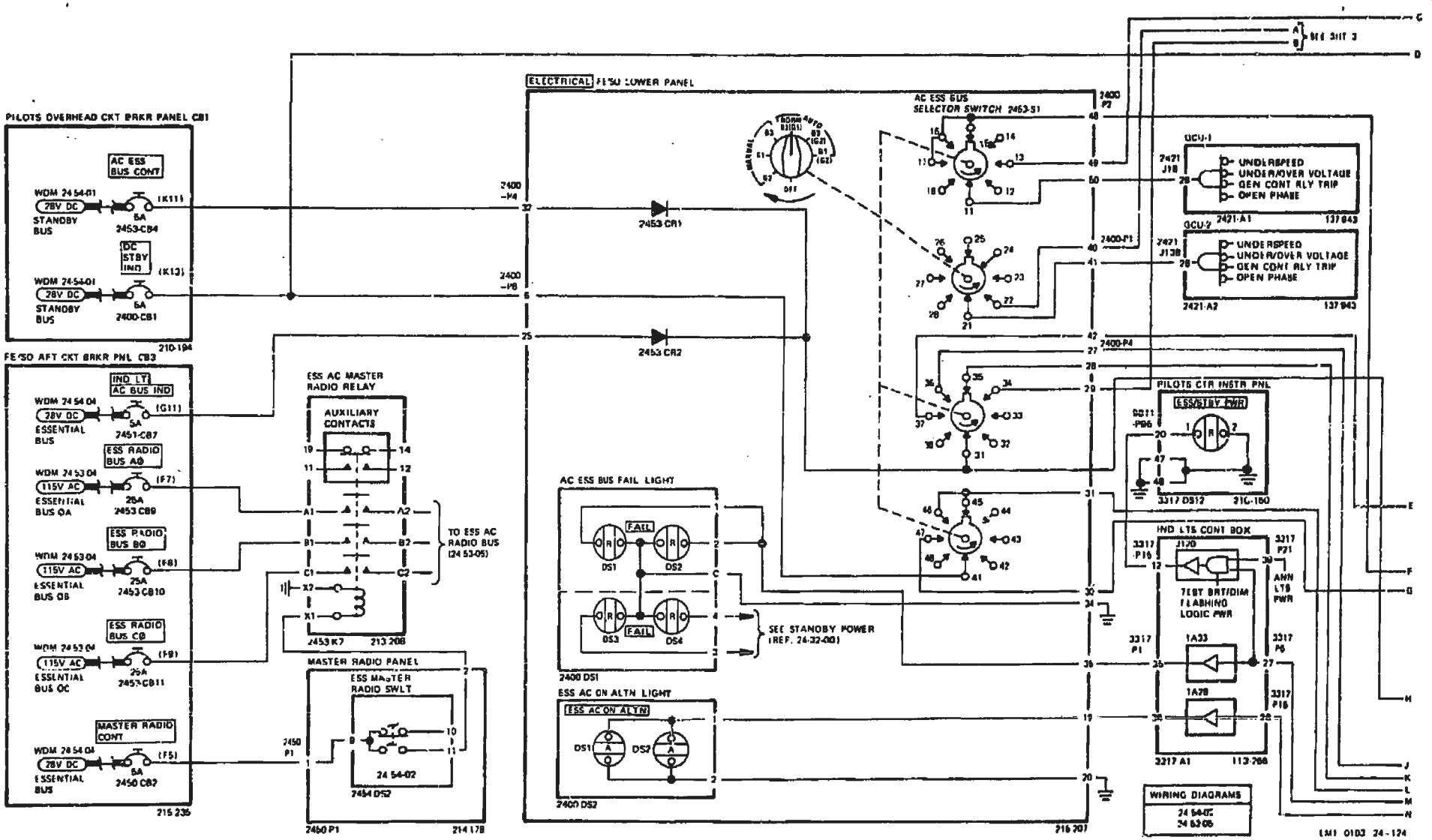

PREREQUISITES
ELECTRICAL POWER (24-41-00)
BATTERY SW IN ON
STANDBY POWER INSTR & RADIO CB (PILOTS OVERHEAD PNL) IN
CB'S: CB1-K11, K13
CB2-H1, H2, H3, H4, H5
CB3-E11, E12, E13, E14
AC ESSENTIAL BUS SELECTOR G1 (G2) FAULT ISOLATION
1 VERIFY THAT ESSENTIAL BUS SELECTOR SW IS IN THE G1 (G2) POSITION. IS AC ESS FAIL LT ON?
YES
NO
5 CHECK FOR 115V AC ON TERM C1, C2, D3 OF RELAY 2453-K4 (MM24-53-03). IS 115V AC PRESENT?
YES
11 REPLACE 2453-K4 RELAY (MM24-53-03).
6 CHECK GEN 1 AND GEN 2 VOLTS.
BOTH NOT OK
12 FAULT ISOLATE ENGINE DRIVEN GENERATOR SYSTEM (MM24-21-00)
GEN 2 OK, GEN 1 NOT OK
GEN 1 OR BOTH OK
7 PLACE ESSENTIAL BUS SELECTOR SWITCH TO THE MANUAL G1 SOURCE. DID AC ESS BUS FAIL LIGHT GO OUT?
YES
13 REPLACE AC SOURCE 1 RELAY K5 (MM24-53-02).
NO
8 CHECK CB3-E12 CIRCUIT BREAKER AND RESET IF TRIPPED. DID CB3-E12 CIRCUIT BREAKER REMAIN CLOSED?
NO
14 REPLACE GEN 1 AC ESS BUS PWR RCCB CB1 (MM24-53-02).
YES
15 REPLACE AC ESS RELAY NO. 1 K1 (MM24-53-02).
9 CHECK CB3-E13 CIRCUIT BREAKER AND RESET IF TRIPPED. DID CB3-E13 CIRCUIT BREAKER REMAIN CLOSED?
NO
16 REPLACE GEN 2 AC ESS BUS PWR RCCB CB2 (MM24-53-02).
YES
17 REPLACE AC ESS RELAY NO. 2 K2 (MM24-53-02).
2 IS ESS AC ON ALTN LT ON?
YES
NO
10 CHECK GEN 1 AND GEN 2 VOLTS.
BOTH NOT OK
18 REPLACE AC ESS BUS SENSING RELAY 2453-K4 (MM24-53-03).
GEN 2 NOT OK
GEN 1 OR BOTH OK
19 REPLACE AC SOURCE 1 RELAY 2453-K5 (MM24-53-02).
3 CHECK CB3-E13 CIRCUIT BREAKER AND RESET IF TRIPPED. DID CB3-E13 CIRCUIT BREAKER REMAIN CLOSED?
NO
YES
4 SYSTEM OPERATIONAL.
20 FAULT ISOLATE ENGINE DRIVEN GENERATOR SYSTEM (MM24-21-00).
21 REPLACE GEN 2 AC ESS BUS PWR RCCB CB2 (MM24-53-02). IF FAULT PERSISTS, CHECK AC ESSENTIAL BUS FOR SHORTS (MM24-53-02).

R R AC Essential Bus Selector G1(G2) Fault Isolation
Figure 105

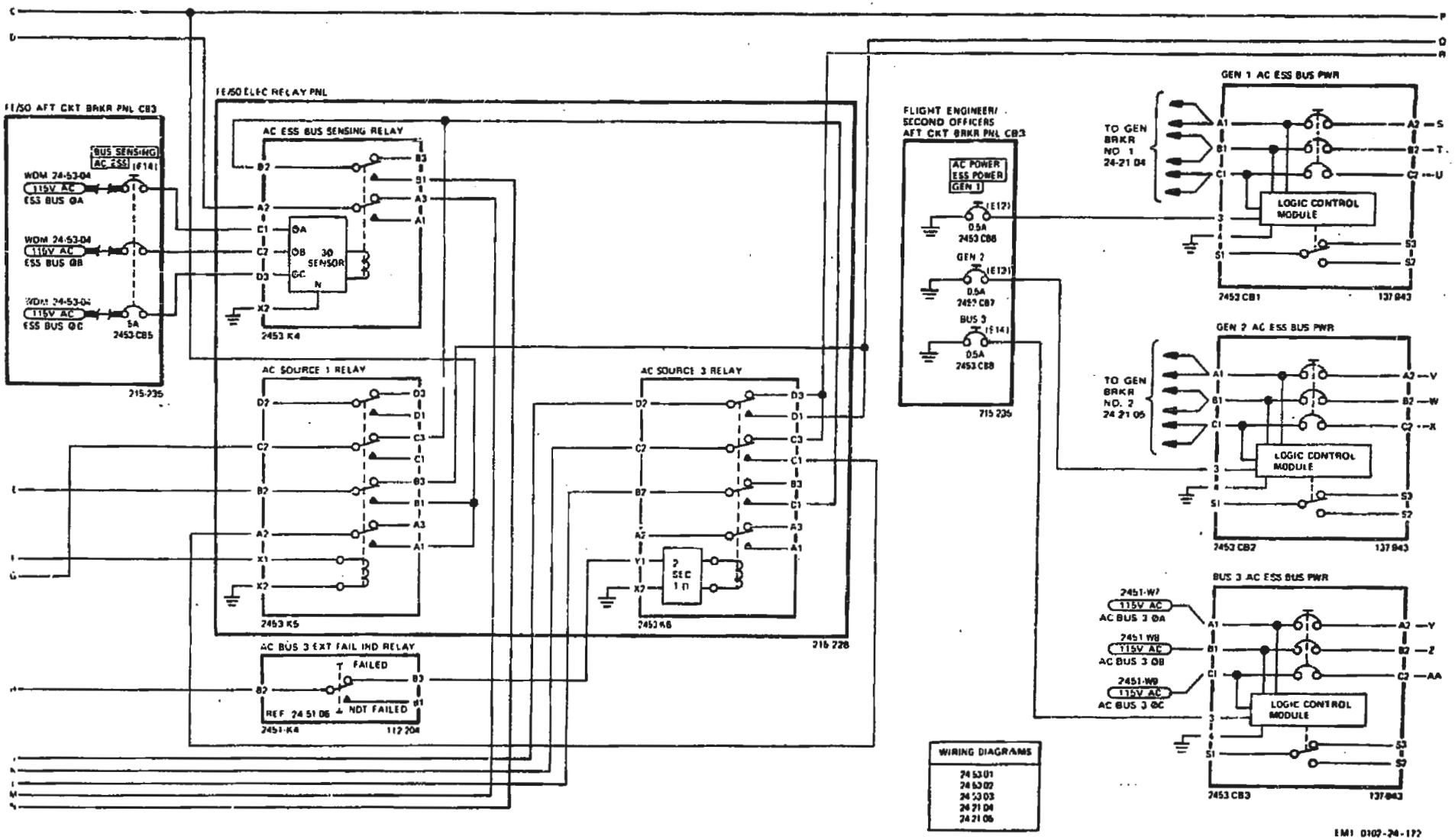
R R EFFECTIVITY: ALL

001B



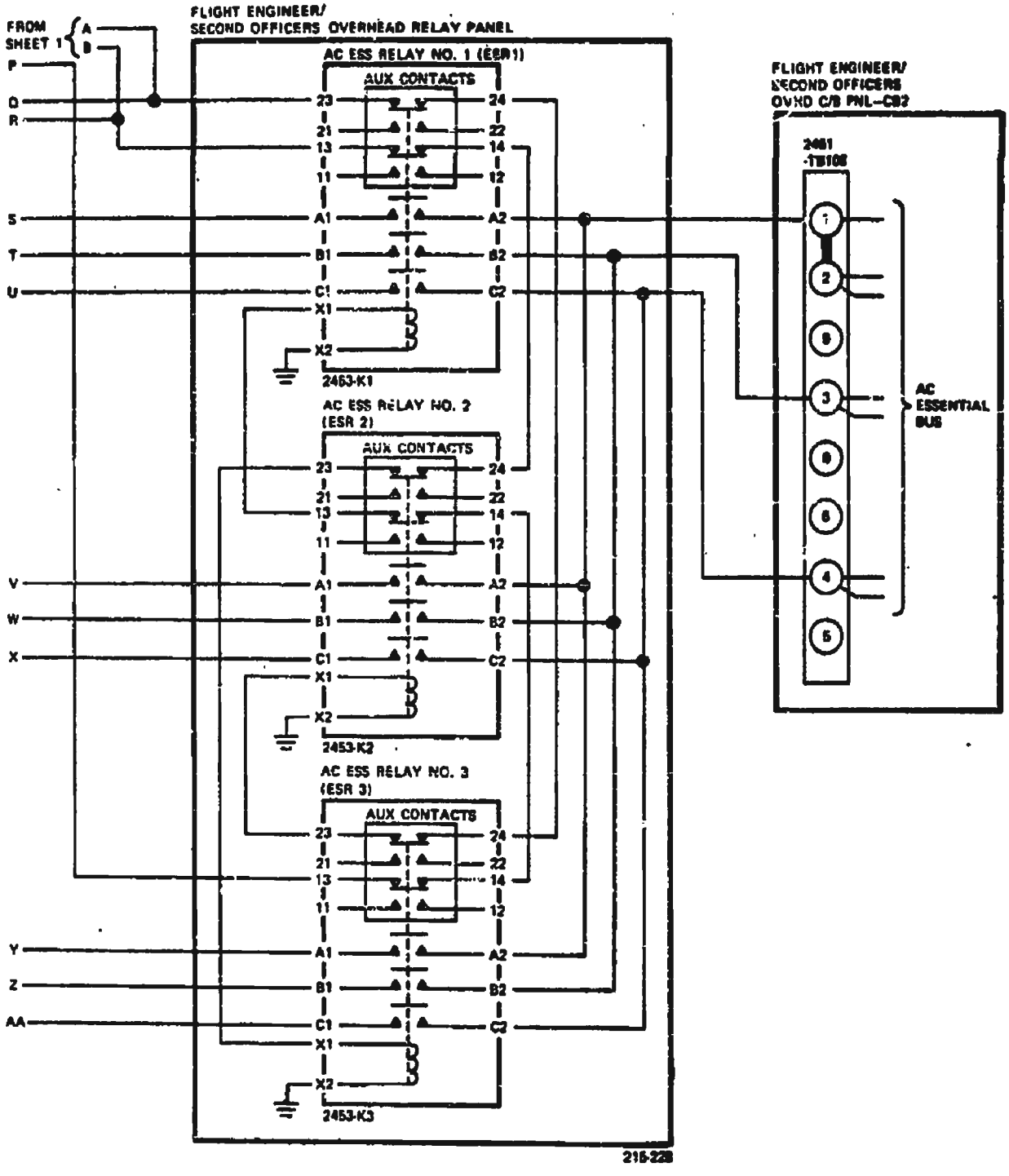
AC Essential Bus Schematic
SCHEM 1 (Sheet 1)

R
R
001B EFFECTIVITY: ALL



AC Essential Bus Schematic
SCHEM 1 (Sheet 2)

R EFFECTIVITY: ALL
R
001B



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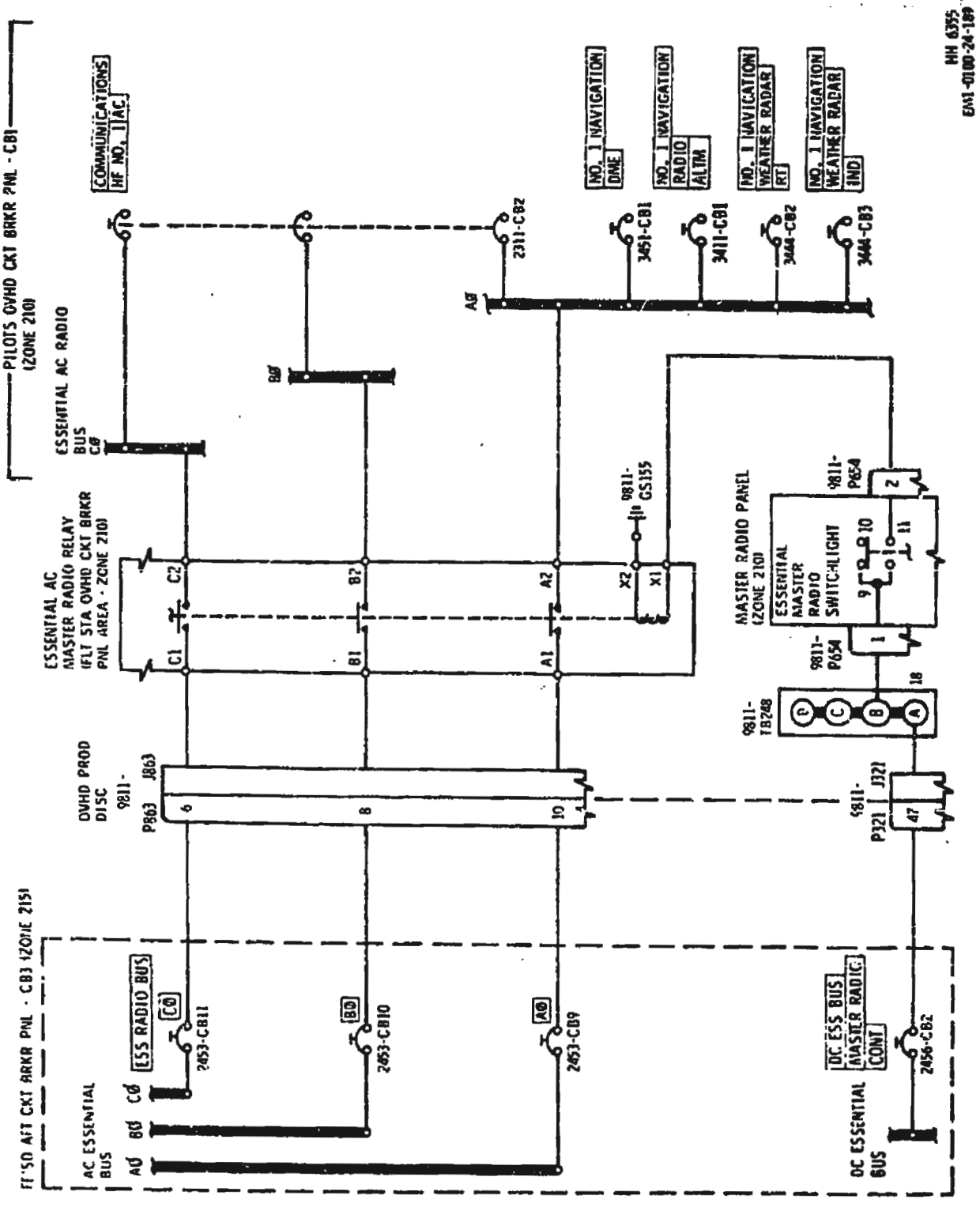
AC Essential Bus Schematic
SCHEM 1 (Sheet 3)

R P 001B

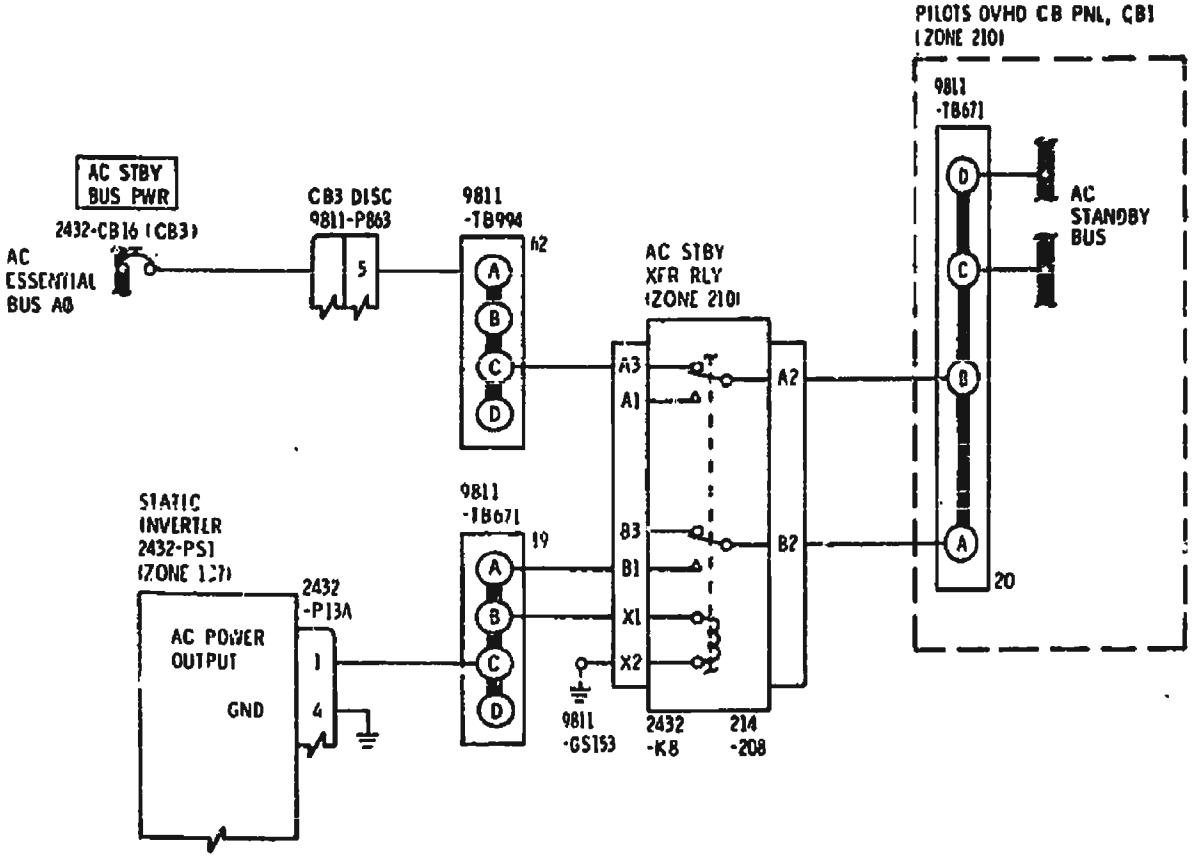
EFFECTIVITY: ALL



Essential AC Radio Bus Schematic
SCHEM 2

R
R
001B

EFFECTIVITY: ALL



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R AC Standby Bus Schematic
R SCHEM 3

EFFECTIVITY: ALL

0018

AC ESSENTIAL RELAY - REMOVAL AND INSTALLATION

1. General

The removal and installation procedures for the three ac essential relays are identical. The relays are accessible by opening the aft panel of the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215.

2. Referenced Procedure

R	24-00-00	Electrical Power - Maintenance Practices
R R	24-41-00	External Power/Ground Service System - Maintenance Practices
R	71-00-00	Power Plant - Adjustment and Test

3. Removal/Installation

A. Removal

(1) On APU CONTROL panel, zone 215, place MASTER POWER switch in OFF position and tag.

(2) On ELECTRICAL panel, zone 215, place EXT PWR switch in OFF position and tag.

(3) Verify that external power source is deenergized and disconnected from receptacle (Ref. 24-41-00). Tag receptacle.

(4) Release panel fasteners and open aft panel of Flight Engineer/Second Officers overhead circuit breaker panel CB2.

(5) Locate relay to be removed; tag and remove all wires.

(6) Remove mounting screws and remove relay.

B. Installation

(1) Ensure that switches tagged in Steps 3A(1) and 3A(2) are in the OFF position and tagged.

(2) Place relay in position and install mounting screws.

(3) Connect wires to relay terminals and remove tags.

(4) Check that relay mounting and wires are secure.

(5) Close circuit breaker panel and secure panel fasteners.

(6) Remove tags from switches installed in Steps 3A(1) and 3A(2).

R NOTE: Following removal and installation of ac
R essential relay No. 1, No. 2, or No. 3, an
R operational check is required. The No. 3 relay
R can be checked using external power, APU
R generator power, or power from any engine-driven
R generator. The No. 1 or No. 2 relays must be
R checked by running their respective engine.

R The check is accomplished by rotating the ac
R essential bus selector switch located on the
R Flight Engineer/Second Officers ELECTRICAL
R control panel, zone 215, to the proper position
R and verifying that the AC ESS BUS FAIL light
R (red), does not come on (light may flash
R momentarily). The light is located adjacent to
R the selector switch.

R To check relay No. 3, perform Steps (7), (8),
R and (9). To check relay No. 1, perform Steps
R (10), (11) and (12). To check relay No. 2,
R perform Steps (13), (14), and (15).

R (7) Energize aircraft electrical system (Ref. 24-00-00)

R (8) Rotate selector switch to MANUAL B3 position and verify
R that AC ESS BUS FAIL light does not come on.

R (9) Deenergize aircraft electrical system (Ref. 24-00-00).

R (10) Start engine No. 1 (Ref. 71-00-00) and run at idle
R speed.

R (11) Rotate selector switch to MANUAL G1 position and verify
R that AC ESS BUS FAIL light does not come on.

R (12) Shut down engine No. 1 (Ref. 71-00-00).

R (13) Start engine No. 2 (Ref. 71-00-00) and run at idle
R speed.

R (14) Rotate selector switch to MANUAL G2 position and verify
R that AC ESS BUS FAIL light does not come on.

R (15) Shut down engine No. 2 (Ref. 71-00-00).

50 AMP CURRENT LIMITER - REMOVAL AND INSTALLATION

1. Referenced Procedures

6-40-00	Exterior Access Doors and Removable Panels - Description and Operation
6-50-00	Interior Access Doors and Removable Panels - Description and Operation
24-00-00	Electrical Power - Maintenance Practices

2. Removal/Installation

A. Removal

R WARNING: DO NOT DISCONNECT BATTERY CONNECTOR UNLESS BATTERY
R SWITCH HAS BEEN PLACED IN OFF POSITION AND BATTERY
R CHARGER CIRCUIT BREAKER IS OPEN.

R (1) On Flight Engineer/Second Officers (FE/SO) ELECTRICAL
R panel place BATTERY switch to off.

R On FE/SO aft circuit breaker panel, zone 215, open and
R tag circuit breaker BAT CHG (A15).

(2) Gain access to mid electrical service center, zone 137 and disconnect battery connector (Ref. 6-40-00, 6-50-00, 24-32-03).

WARNING: HIGH VOLTAGES IN THIS AREA CAN BE FATAL.

(3) Remove cover to battery charger box.

(4) Locate current limiter in battery charger box (Ref. Fig. 401).

(5) Unscrew two hold screws securing current limiter.

(6) Remove current limiter.

B. Installation

(1) Ensure that circuit breaker opened in Step 2A(1) is opened and tagged.

(2) Install current limiter.

(3) Close and secure cover to battery charger box.

R (4) Connect battery connector and place battery switch in
R ON position and close battery charger TRIP/SET circuit
R breaker.

C. Component Check

(1) Close circuit breaker opened in Step 2A(1).

WARNING: BEFORE TURNING ON ELECTRICAL SYSTEM, ENSURE THAT ALL CONCERNED PERSONNEL ARE NOTIFIED.

HIGH VOLTAGES CAN BE FATAL.

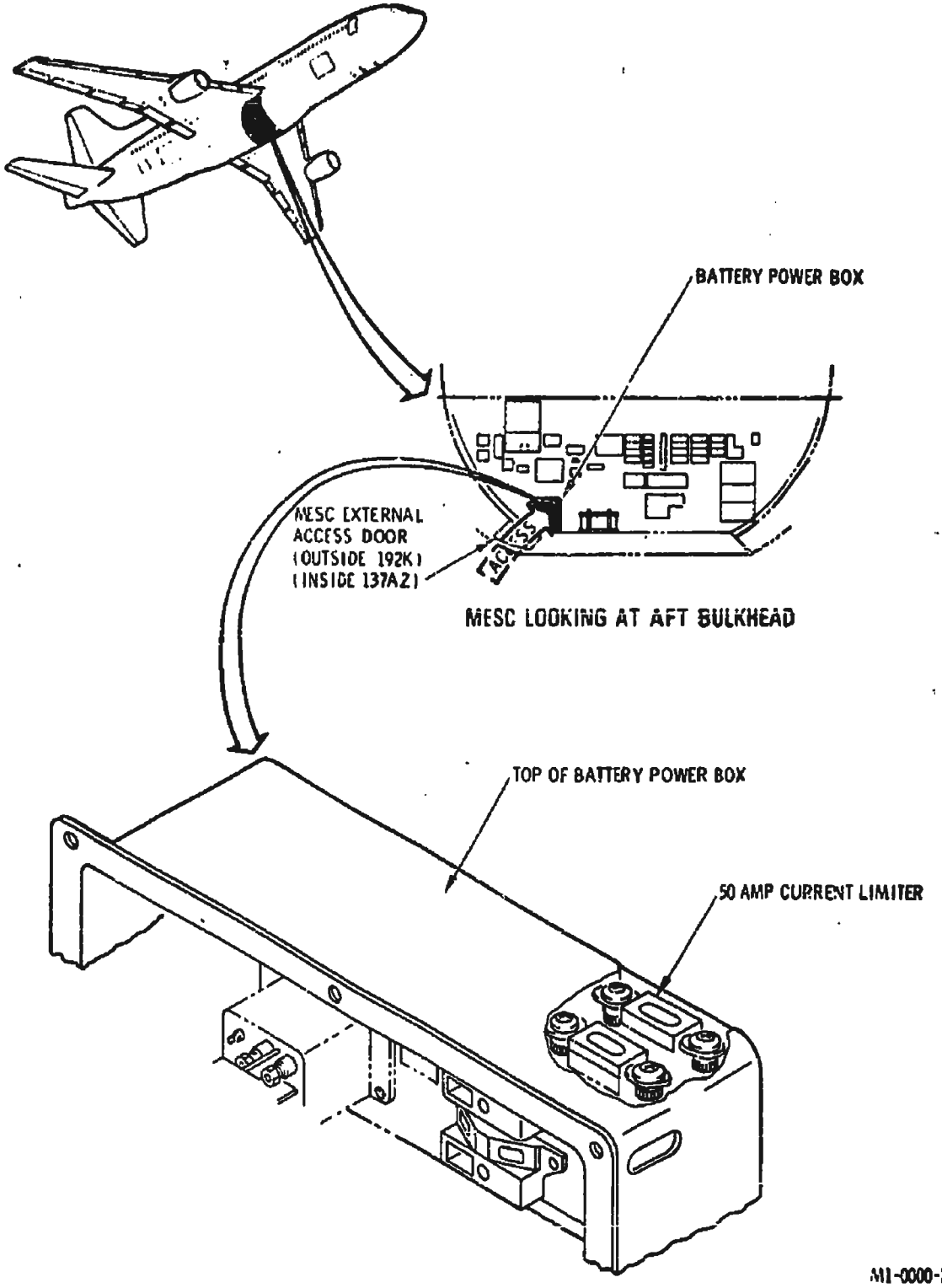
(2) Turn on aircraft electrical system (Ref. 24-00-00).

(3) Place BUS VOLTS T/R AMPS selector switch on Flight Engineer/Second Officers ELECTRICAL control panel, zone 215, in BAT position, and verify normal charger operation on adjacent dc voltmeter and dc ammeter.

NOTE: Battery charger output is dependent on condition of battery. If DC VOLTS meter indicates less than 30V, DC AMPS meter will indicate negative 40 amp. If the DC VOLTS meter indicates more than 30V, the DC AMPS meter will indicate a frequent negative 40-amp pulse which drops back to zero rapidly. The above conditions are for normal ambient temperature conditions. Meter indications will vary with battery temperature.

(4) Turn off aircraft electrical power system (Ref. 24-00-00).

(5) Close and secure access doors.



50 AMP Current Limiter - Removal and Installation
Figure 401

AVIONIC 26V AC SUPPLY TRANSFORMER - REMOVAL AND INSTALLATION

1. General

Three 115/26V ac stepdown transformers each supply 26V, 400-Hz, single-phase power to the avionics systems. One 300- and two 100-Voltampere units are provided. The transformers are mounted on a vertical mounting bracket beneath the flight station floor just forward of access door 211CB. Access to the transformers is through the forward electronic service center access door 112AB.

2. Removal/Installation

A. Removal

(1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers NO. 1 INSTRUMENT - INSTR XFMR NO. 1, NO. 1 NAV a INSTR - INSTR XFMR NO. 2, and NO. 2 INSTRUMENTS - INSTR XFMR NO. 3.

(2) On transformer to be removed, tag and remove wires attached to transformer lugs by sliding insulation sleeving away from soldered terminals and unsoldering wires.

(3) Remove nuts from mounting screws and remove transformer.

B. Installation

(1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

(2) Place transformer in position. Install and tighten nuts.

(3) Solder wires to terminals on transformer lugs and remove tags.

(4) Slide insulation sleeving over soldered terminals.

(5) Remove tags and close circuit breakers opened in Step 2A(1).

DC ESSENTIAL AND STANDBY BUS SYSTEM - DESCRIPTION AND OPERATION

1. General

The dc essential bus energizes essential circuits which are protected by circuit breakers on the pilots overhead circuit breaker panel CB1, zone 210, and on the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215. The dc standby, the essential dc radio, and the essential communications buses energize essential circuits which are protected by circuit breakers on the pilots overhead circuit breaker panel CB1.

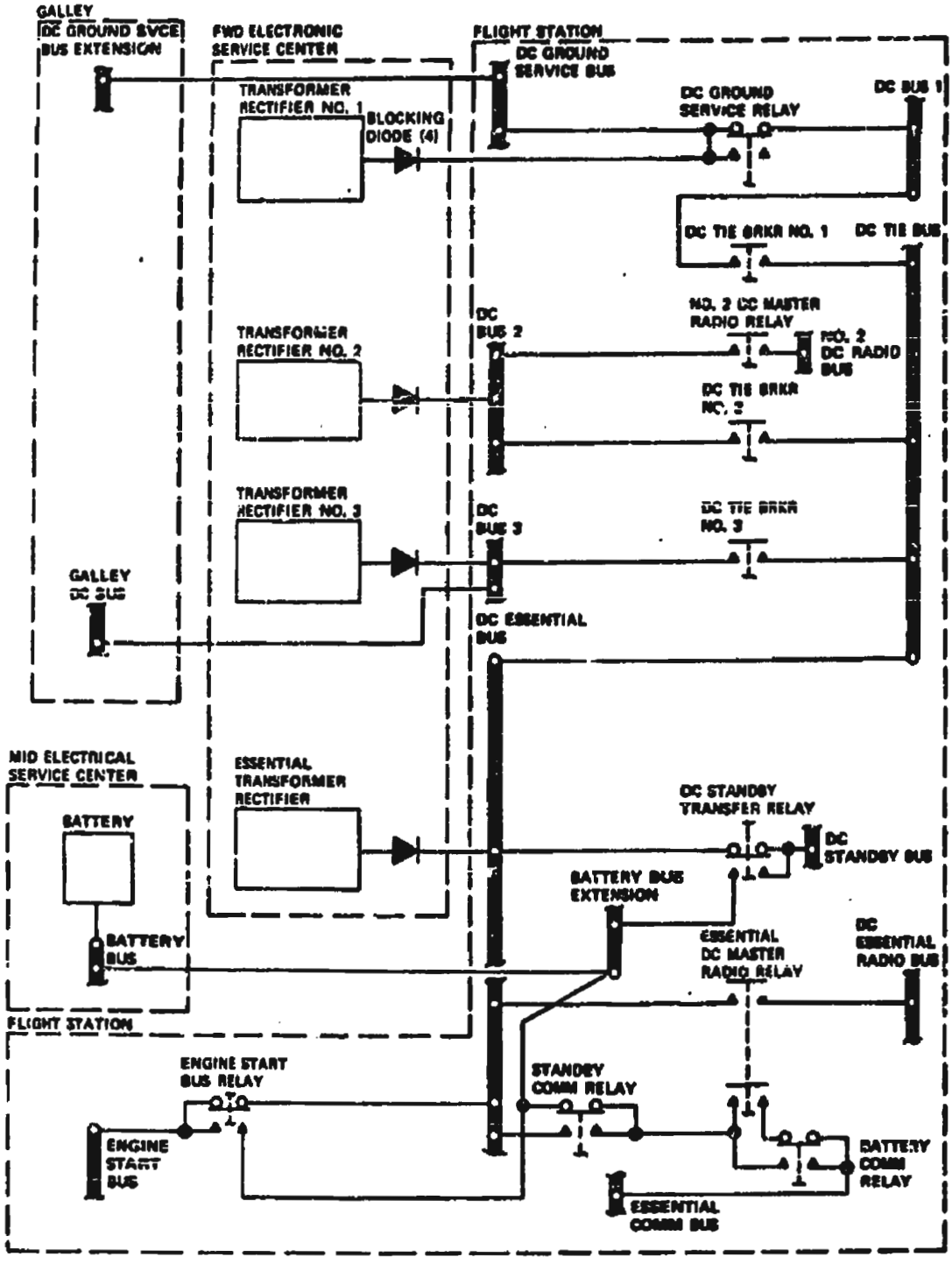
2. Operation

The dc essential bus (Ref. Fig. 2) is energized directly from the essential Transformer-Rectifier (TR) (through a blocking diode) whenever the TR is operating. The bus is also connected to the dc tie bus through an ESSENTIAL BUS DC TIE BUS POWER circuit breaker on the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215. This arrangement assures essential dc bus power whenever any TR is operating, provided the associated bus tie breaker is closed.

The dc essential radio bus (Ref. Fig. 2) is energized from the dc essential bus through contacts of the energized essential dc master radio relay. The essential communications bus (Ref. Fig. 2) is normally energized from the dc essential bus. The energizing circuit is through contacts of the energized standby communications and essential dc master radio relays and through
R contacts of the deenergized battery communications relay.

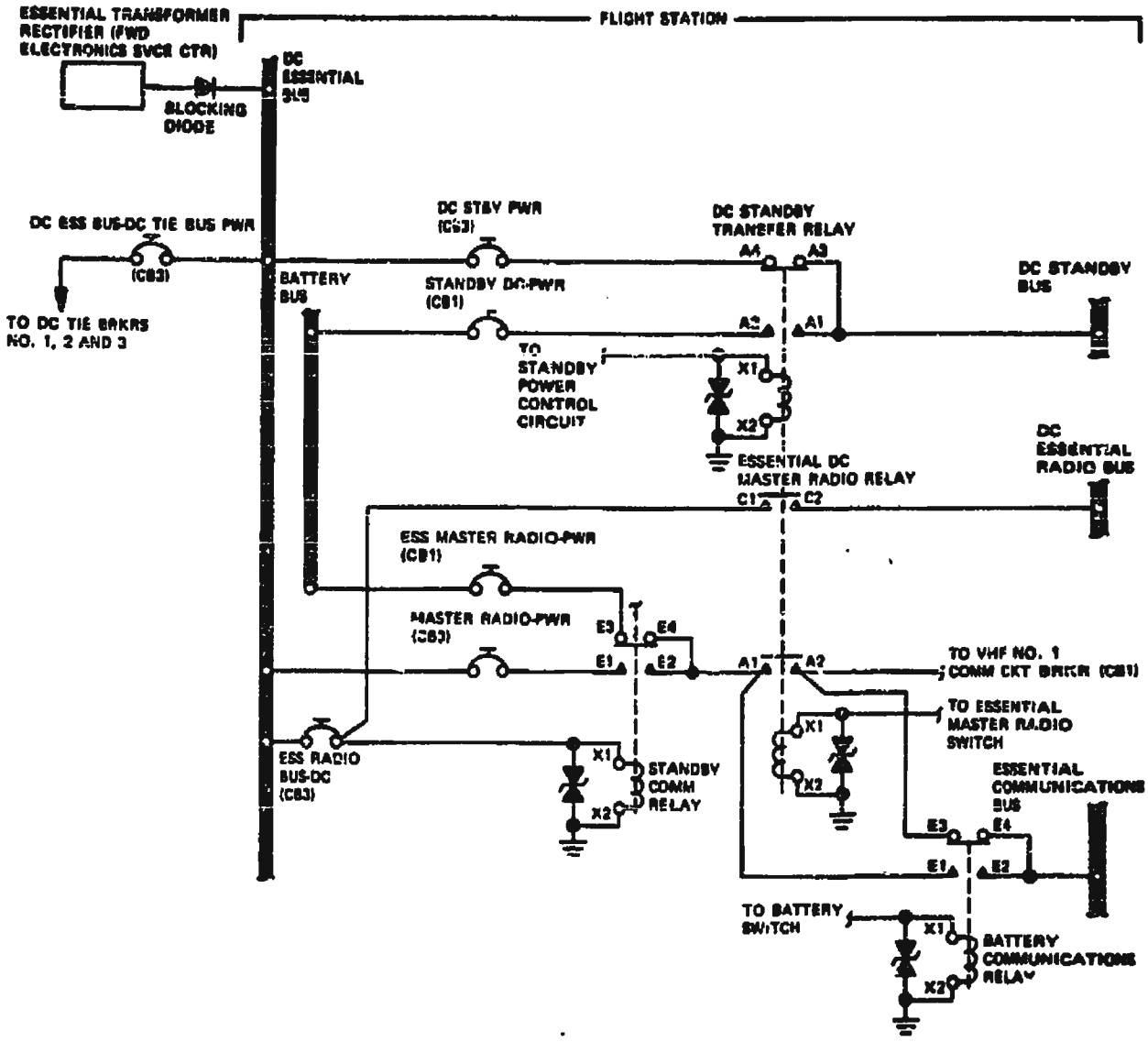
With the BATTERY switch on the Flight Engineer/Second Officers electrical control panel, zone 215, in the ON position, and the ESSENTIAL MASTER RADIO switchlight on the pilots overhead panel,
R zone 210, in the OFF position (latched out) the battery communications relay is energized and the essectial dc master radio relay is deenergized. In this condition, the essential communications bus is energized from its normal power source (the dc essential bus). If the normal power source fails, the standby communications relay transfers the bus from its normal power source to its alternate source (the battery bus).

The dc standby bus (Ref. Fig. 2) is normally energized from the dc essential bus through contacts of the deenergized dc standby transfer relay. If the dc essential bus fails with the BATTERY switch in the ON position, the dc standby transfer relay transfers the bus from the dc essential to the battery bus.



EM1-0001-24-1004

R
R DC Bus Distribution Simplified Schematic
Figure 1



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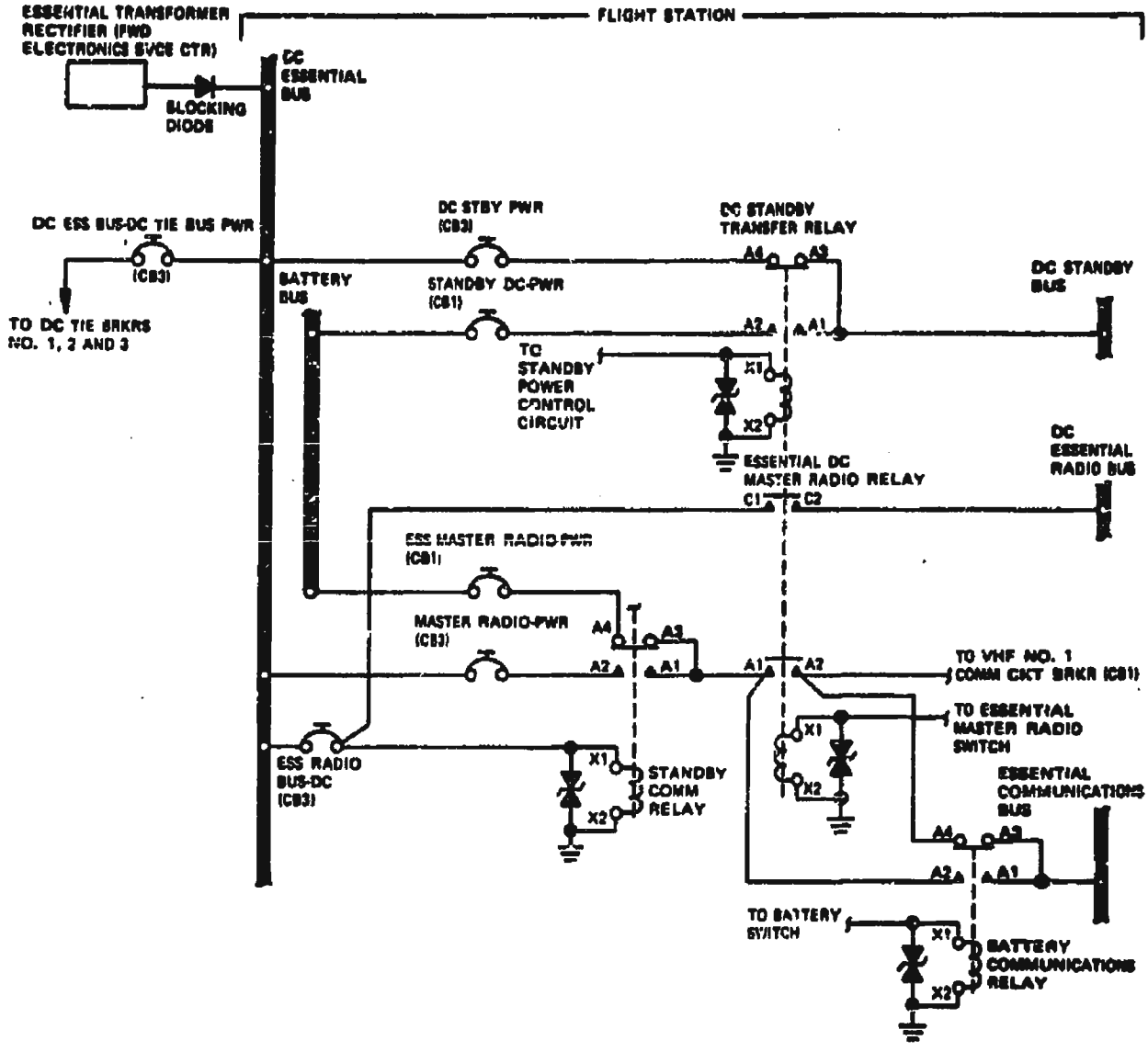
DC Essential and Standby Bus System
Figure 2



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DC Essential and Standby Bus System
Figure 2

BATTERY BUS SYSTEM - DESCRIPTION AND OPERATION

1. General

The battery bus system consists of a battery bus and a battery bus extension. The battery bus is located in the mid electrical service center, zone 137. The extension is located in the flight station area, zone 210. An APU battery bus is located in the aft electronic equipment area, zone 164, and is described in the APU power system (Ref. 24-36-00). The battery bus is connected directly to the battery with a Teflon-encased copper wire. The bus extension is connected to the battery bus with a Teflon-encased copper wire, through a current limiter located in the battery power distribution box in the mid electrical service center.

The battery bus provides power to start and control the APU, and to energize the APU battery bus under certain conditions (Ref. 24-36-00). The bus also provides an alternate power source for refueling when no other power is available. The battery bus extension connects 26-volt battery power to circuit breakers feeding critical circuits originating in the flight station, zone 210. The critical circuits are: engine start power, fire alarm, fire extinguishing, fuel shutoff valves, emergency evacuation signals, and other emergency systems.

TOP

Film Identification

Century

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St. Paul, MN 55119

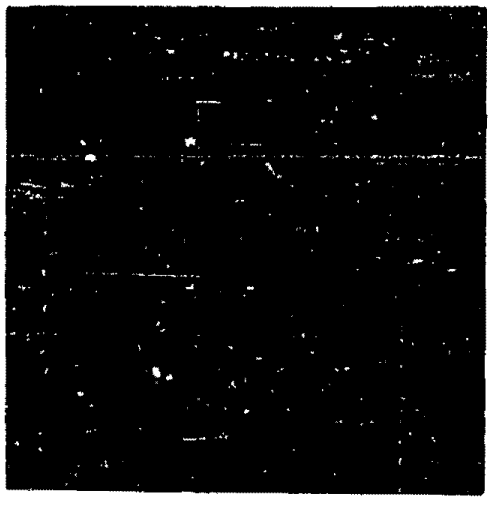
PRECISION[SM] RESOLUTION TARGETS

LEFT

RIGHT

150 MM

6"



PM-3 8½"x11" PHOTOGRAPHIC GENERAL TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT